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SITE: Brown's Dump
BREAK: 3.12
OTHER:

FINAL
ECOLOGICAL RISK ASSESSMENT

BROWN'S DUMP
Superfund Site
Jacksonville, Duval County, Florida

BLACK & VEATCH Special Projects Corp.

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FINAL
Ecological Risk Assessment

BROWN'S DUMP
Jacksonville,
Duval County, Florida

U.S. EPA Work Assignment No. 007-RSBD-A496
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Appendices

1.0 Introduction

This report encompasses all ecological risk assessment activities at the Brown's Dump Site located in Jacksonville, Duval County, Florida through Step 3A of the Interim Final 8-Step Ecological Risk Assessment Process for Superfund (EPA 1997) developed by the U.S. Environmental Protection Agency (EPA). This report, hereafter referred to as the Ecological Risk Assessment (ERA), is inclusive of both the terrestrial and aquatic environments at the Site identified in a Screening-level Ecological Risk Assessment (SERA) (Black & Veatch, 2000). The final SERA for the Site, approved by EPA in March 2000, was based on analytical data collected during and prior to 1997. The SERA had completed Steps 1, 2 and 3 of the 8-Step Process; however, additional sampling of the site and surrounding areas was conducted by CH2M Hill in April 2000. The additional sampling of sediment and surface water in Moncrief Creek was required to present a more adequate assessment of the aquatic environment after maintenance dredging activities which occurred in 1999. Additional surface soil sampling was also conducted to better define the nature and extent of incinerator ash deposits.

The site and ecological characterization of the site (Step 1 of the 8-Step process) has not changed since the issuance of the final SERA. However, based on the analytical data for the more recent April 2000 sampling, portions of Step 2 (and therefore, Step 3) are changed by this more recent data. Since the SERA has fully and adequately completed Steps 1 and portions of Step 2 of the ecological risk assessment process, this ERA will not include detailed discussion of the environmental setting, site history, or potential complete pathways; however, this information is included in this ERA as Appendix A. This ERA will focus on the following:

- Revise the abiotic screening portion of the final SERA with the April 2000 data (Step 2; Section 2.0 of this ERA) and
- Refine the list of preliminary contaminants of potential concern (Step 3a; Section 3.0 of this ERA) and present preliminary remedial goals (Step 3a; Section 5 of this ERA).

2.0 Revised Abiotic Screening (ERA Step 2)

The abiotic screen includes a comparison of the contaminants detected in surface soil, sediment, and surface water (freshwater) to ecological screening values (ESVs). The ESVs were selected in conjunction with EPA Region 4, in order of preference, from the following EPA ecological screening level documents:

- EPA Region 4 screening values as published in EPA Region 4 Ecological Risk Assessment Bulletins -- Supplement to RAGS [1999].
- EPA Region 5 RCRA Environmental Data Quality Levels (EDQLs; EPA 1999).

As stated previously, environmental samples of surface soil, sediment, and surface water were collected in April 2000 by CH2M Hill to supplement the existing data set for the site. The data resulting from the April 2000 investigations was presented in a *Microsoft Access 2000* database from which various queries were made to develop an inclusive list of all contaminants evaluated. These data were then organized by media and compared to the selected screening values. ESVs for surface soil, sediment, and surface water are shown in Tables 2-1, 2-2, and 2-3. Each media was evaluated as follows:

- Surface Soil – Section 2.1
- Sediment – Section 2.2
- Surface Water – Section 2.3

2.1 Surface Soil Screening

Over 650 surface soil samples were collected from neighborhoods and other areas on and around the Brown's Dump Site. While all of these surface soil samples were analyzed by X-ray Fluorescence (XRF) for lead, 101 of these samples were also analyzed for TAL metals, 34 of these samples were also analyzed for dioxins, semivolatile organic compounds (SVOCs), pesticides, and polychlorinated biphenyls (PCBs), and 11 of these samples were also analyzed for volatile organic compounds (VOCs). XRF samples are not be used in this risk assessment since screening data is not suitable for risk assessment purposes as per EPA Guidance. Fifteen of these surface soils samples were collected in locations believed to be representative of reference conditions. Due to questions raised about obtaining "true" reference samples in an area where the boundaries of the ash have not yet been determined, inorganic compounds detected in soil were not screened against the reference (or reference) samples. Based on these uncertainties, reference data has not been considered as a rationale

for eliminating or including contaminants of potential ecological concern in this ERA. These sample locations can be found in Figure 4 of the Preliminary Site Characterization for Brown's Dump Site (CH2M Hill Team, August 2000).

The surface soil analytical data set from the April 2000 sampling was screened against the selected ESVs and is presented in Table 2-4. This initial screening indicated that several contaminants were present at concentrations exceeding these ESVs. Contaminants exceeding screening values (those presenting a screening hazard quotient, or HQ, of 1 or greater) were retained as preliminary contaminants of ecological concern (PCOPEC). PCOPEC for surface soils are identified in Table 2-7.

2.2 Sediment and Surface Water Screening

Thirteen co-located sediment and surface water samples were collected from Moncrief Creek. Five of these sample stations were in locations upgradient of the site believed to be representative of reference conditions. Five sample stations were in locations adjacent to the site (in areas believed to have been dredged since the original 1997 sampling) and three sample stations were in locations downstream of the site. All 13 samples were analyzed for TAL metals, SVOCs, pesticides, and PCBs. Three of these samples were also analyzed for dioxins and VOCs. These sample locations can also be found in Figure 4 of the Preliminary Site Characterization for Brown's Dump Site (CH2M Hill Team, August 2000)

The sediment analytical data results were screened against the selected ESVs for sediment and are presented in Table 2-5. This initial screening indicated that several contaminants were present at concentrations exceeding these ESVs. Contaminants exceeding screening values (those presenting a screening HQ of 1 or greater) were retained as PCOPEC. PCOPEC for sediment are identified in Table 2-7.

The surface water analytical data results were screened against the approved ESVs for surface water and are presented in Table 2-6. This initial screening indicated that several contaminants were present at concentrations exceeding these ESVs. Contaminants exceeding screening values (those presenting a screening HQ of 1 or greater) were retained as PCOPEC. PCOPEC for surface water are identified in Table 2-7.

When inorganics were detected in unfiltered samples, they were identified as PCOPEC and were refined based on a comparison of the related filtered sample result to the National Ambient Water Quality Criteria (NAWQC) in a later section of this ERA.

2.3 Comparison of Pre- and Post-Dredging Sediment and Surface Water Data Sets

Several sources have indicated that the portion of Moncrief Creek adjacent to the Brown's Dump Site has been dredged for maintenance purposes after the 1997 sampling. As a result, sediment and surface water samples were collected in April 2000 to present current conditions. Because of the differences between these two data sets, EPA required this ERA to compare these data sets to determine what effect, if any, these data have on the ecological risks in Moncrief Creek.

2.3.1 Sediment Data Comparison

The sediment sample data collected in 1997 from 4 locations in Moncrief Creek indicated that metals, pesticides, and PAHs are at concentrations that exceed USEPA Region 4 ecological screening values. Two of the sediment samples collected in April 2000 correspond with locations sampled previously (BDSW004 [2000] = BDSD-03 [1997] and BDSW005 [2000] = BDSD-04 [1997]). A comparison of the new data to the old data indicates the following:

- Data from sample BDSD-03 in the 1997 sampling event does not correlate well with data from the same location collected in the recent sampling round (BDSW004).

- Lead, copper, mercury, and zinc concentrations identified in 1997 sample BDSD-04 (760JN, 190, 0.62, and 810 mg/KG, respectively) are much higher than the maximum concentrations in the corresponding April 2000 sample (14 J, 6.2 J, 0.011 J, and 52 mg/KG, respectively). This may suggest that the dredging effectively removed much of the contaminated sediment. Another possibility for the significant difference in the results of these two data sets is differences in data quality. The highest value of lead in sediment in 1997 was in a JN-qualified result. The result was more than likely biased high due to interferences with other metals in the sample.

- With the exclusion of BDSD-03and BDSD-04 in the 1997 data set, the data from the recent sampling is similar in terms of the detected contaminants and range of detected concentrations.

- Dioxins were not analyzed for in the 1997 data set. It is important to note that in the April 2000 data set, the reference samples contained higher dioxin concentrations than the samples collected adjacent to the site. Due to questions raised about obtaining "true" reference samples in an area where the boundaries of the ash have not yet been determined, inorganic compounds were not screened against the reference samples.

The data comparison appears to confirm that areas sampled at BDSD-03 and BDSD-04 (portions of Moncrief Creek adjacent to the site) have been dredged based on the stark differences between the two data sets at these locations. Given this variation and the potential for downgradient migration of suspended sediments (possibly verified by the downgradient samples in the April 2000 data set), the remainder of this ERA will be based on the April 2000 sediment samples.

2.3.2 Surface Water Data Comparison

The original data collected in 1997 from 4 surface water samples (co-located with sediment samples) indicated that lead and zinc are at concentrations that exceed USEPA Region 4 ecological screening values. Two of the surface water samples collected in April 2000 correspond with locations sampled previously (BDSW004 [2000] = BDSW-03 [1997] and BDSW005 [2000] = BDSW-04 [1997]). A comparison of the new data to the old data indicates the following:

- There is little to no correlation between the 1997 and 2000 data sets.

- The new data indicates that all contaminants detected in surface water were below ecologically significant levels with the exception of lead and cyanide.

The data comparison appears to support the assumption that areas sampled at BDSD-03 and BDSD-04 (portions of Moncrief Creek adjacent to the site) have been dredged based on the stark differences between the two data sets at these locations.

3.0 Refinement of PCOPEC (ERA Step 3a)

In Step 3a of the ecological risk assessment process, the PCOPEC are refined to determine the need for, or focus, further investigations. Contaminants that exceeded the approved ESVs, or that could not be screened due to a lack of an ESV, (and therefore identified as PCOPEC in Table 2-7) were primarily evaluated based on an approved set of ecological refinement values (ERVs). The ERVs for each contaminant were approved by EPA's Ecological Technical Assistance Group (ETAG) based on a comparative analysis of the available toxicological studies. Based on the ecological setting and the list of PCOPEC, a preliminary ecological exposure model was developed and is presented on Figure 3-1. The preliminary ecological exposure model presents the most significant exposure pathways to ecological receptors based on the following principal exposure routes:

- Direct exposure to the contaminant in a media of concern
- Food chain transfer of the contaminant in biological tissue of prey organisms

The refinement of PCOPEC to determine contaminants of potential ecological concern (COPEC) through direct exposure is presented in Section 3.1.

The refinement of PCOPEC to determine COPEC through food chain exposure is presented in Section 3.2.

3.1 Refinement of PCOPEC for Direct Exposure

The refinement of PCOPEC to identify COPEC through direct exposure is based on a comparison of each media data set to the approved ERVs, frequency of detection, magnitude of exceedance, and geospatial distribution. In addition, essential nutrients detected in site samples (calcium, magnesium, potassium, and sodium) were eliminated as COPEC when their concentrations were within normal levels in each media.

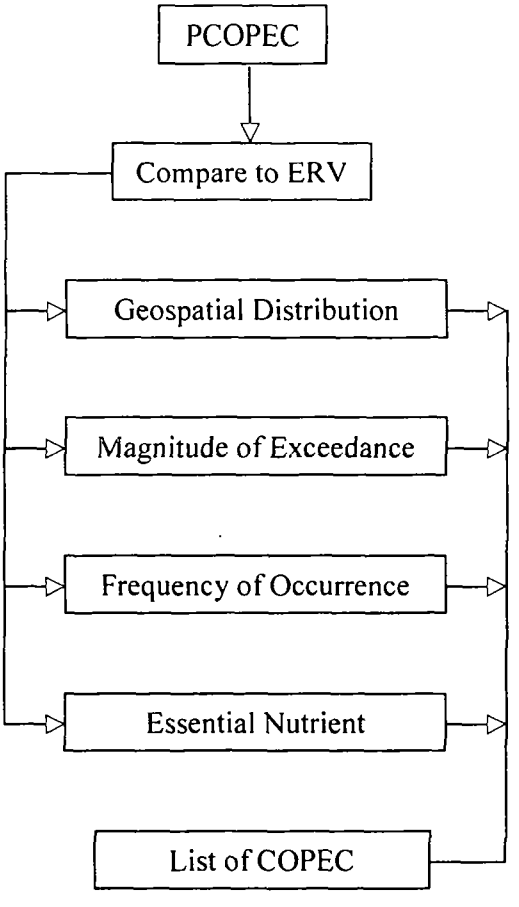
ERVs are alternative toxicological reference values available in the scientific literature that are generally less conservative than ESVs and may present a more focused view of the risks presented by contaminants detected at the site. ERVs used in this ERA for use at the Brown's Dump Superfund Site were developed in conjunction with EPA Region 4.

In evaluating frequency of detection, it is common practice in risk assessment to eliminate contaminants that are present in less than 5 percent of the data set for each media. In

general, this approach was also used in this ERA. However, it is also important to consider that contaminants detected in isolated samples (and less than 5 percent of the data set) may indicate potential hot spots. When contaminants detected in hot spots were associated with related contaminants at the same location, these contaminants were also retained as direct exposure COPEC.

When considering the magnitude of exceedance for refining COPEC, contaminants with HQs of less than 5 were considered for elimination when there were limited samples from the entire data set for that media that presented the high HQ. However, when contaminants with HQs between 1 and 5 were detected in hot spots and were associated with other contaminants at the same location, these contaminants were also retained as direct exposure COPEC.

A flow diagram showing the typical refinement process used to identify COPEC for direct exposure is presented below:



3.1.1 Surface Soil

A large number of contaminants were identified as PCOPEC in surface soil during the initial screening as presented in Table 2-7. In this refinement, these PCOPEC were initially compared to the ERVs as shown in Table 2-4. The ERVs were selected in conjunction with EPA Region 4. The order of preference in selecting the ERVs was developed on the basis of the similarity of the test organisms to the site environment, the general acceptability of the data within the scientific community, and the use of the ERVs by other regulatory bodies.

In selecting these soil ERVs, the data presented in Efroymson et al. (1997) was preferred because it summarized the data from a large variety of studies and recommended the most conservative value from those studies. In addition, this data considered plants, earthworms, and soil microbes, all of which are likely to be key elements in the ecosystem at the Brown's Dump Site. Finally, the data presented in Efroymson is largely accepted for screening ecological risks by other EPA regions and several other regulatory agencies. The next order of preference for selecting ERVs was developed from the Draft Ecological Soil Screening Levels (Eco SSLs) (2000). While these Draft Eco SSLs are being developed specifically for the purpose of screening ecological risks, the Draft Eco SSLs are incomplete; therefore, they are not considered to be a prime source of ERVs in this refinement. The last order of preference is the Canadian Soil Quality Guideline (SQG) for parklands (1999). The Canadian SQGs for parklands were developed to consider the ecological risks to organisms using these parklands; however, the data used in developing these SQGs is biased toward protection of human receptors. The detailed order of preference for selecting soil ERVs is as follows:

1. Efroymson, R.A., Will, M.E, and Suter, G.W. 1997. Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Soil and Litter Invertebrates and Heterotrophic Process: 1997 Revision. Prepared by Lockheed Martin Energy Systems Inc. – Table 1 - Earthworms.
2. Efroymson, R.A., M.E, Suter, G.W., and Wooten A.C. 1997a. Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Terrestrial Plants: 1997.
3. Efroymson, R.A., Will, M.E, and Suter, G.W. 1997. Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Soil and Litter Invertebrates and Heterotrophic Process: 1997 Revision. Prepared by Lockheed Martin Energy Systems Inc. - Table 2 – Soil organisms and microbial processes.

4. EPA 2000. Ecological Soil Screening Level Guidance – Draft. Office of Emergency and Remedial Response. Washington, D.C., July 2000 (Earthworms).
5. EPA 2000. Ecological Soil Screening Level Guidance – Draft. Office of Emergency and Remedial Response. Washington, D.C., July 2000 (Plants).
6. CCMOE, 1999b. Canadian Council of Ministers of the Environment, Canadian Environmental Quality Guidelines, Canadian Soil Quality Guidelines for the Protection of Environmental and Human Health – Summary Tables, 1999.

3.1.1.1. Dioxins and Furans. Chlorodibenzo-p-dioxins were detected in 32 of 32 surface soil samples. There are 17 toxic congeners of chlorodibenzo-p-dioxin and chlorodibenzofurans. They all share chlorination at the 2, 3, 7, 8 positions, and are variable in chlorination at the 1, 4, 6, 9 positions. The toxicity varies with the number and position of chlorines and generally decreases with additional chlorines. The toxicity of these compounds is expressed as a fraction of the most toxic congener, 2,3,7,8-tetrachlorodibenzo-p-dioxin (2,3,7,8-TCDD), so that the toxicity equivalency factor (TEF) for 2,3,7,8 TEF = 1.0, while 2,3,7,8-tetrachlorodibenzofuran is considered 1/10 as toxic and has a TEF of 0.1, and the least toxic, octachlorodibenzofuran, has a TEF of 0.001. The normal procedure reported by the laboratory is to assay for all 17 congeners and mathematically sum the absolute amounts of each toxic congener multiplied by the TEF. This sum, the toxicity equivalency quotient (TEQ), represents an estimate of the dioxins for regulatory purposes.

TEQ of 2,3,7,8-TCDD (Method 8290) was reported in 10 of 10 surface soil samples at a range of 0.33 to 68.6 ng/kg. There were no EPA Region 4 screening values for this contaminant; however, these samples exceeded the EPA Region 5 RCRA EDQL value of 0.199 ng/kg. There were no plant, earthworm, or soil microbial toxicity thresholds identified in Efroymson et al. (1997a;b). TEQ of 2,3,7,8-TCDD was not analyzed for in the reference samples. Reinecke and Nash (1984) found that concentrations of 2,3,7,8-TCDD as high as 5 mg/kg to be non-toxic to earthworms. Given all this information, chlorodibenzo-p-dioxin and chlorodibenzofurans may not be contaminants of potential concern to the soil invertebrate community. However, 2,3,7,8-TCDD was retained for analysis of food-chain exposure to higher trophic level receptors.

3.1.1.2. Inorganics. Several of the inorganic PCOPECs are essential nutrients effectively bioregulated by most organisms. As a result, ecological toxicity data for these nutrients (calcium, magnesium, sodium, and potassium) are lacking due to a general lack of significant concern. It is highly unlikely that these constituents, by themselves, present

significant ecological risk. Based on this information these compounds were eliminated as COPECs.

All of the remaining inorganic PCOPECs are naturally present in surface soil at the site and may not represent a site-related ecological risk. To differentiate between typically occurring and site-related constituents, the remaining inorganic PCOPECs were compared to the range of concentrations in the reference samples for each constituent. In general, this comparison indicated that inorganic concentrations identified on the site are higher than those in reference soils. It is important to note that contaminants are not screened on the basis of comparison to reference concentrations.

Aluminum was detected in all 86 samples at concentrations ranging from 580 to 27,000 mg/kg, all of which are above the EPA Region 4 screening value of 50 mg/kg. The EPA Region 4 screening value is based on plant toxicity data presented in Efroymson et al. (1997a). The detected aluminum concentrations are also above toxicity data for soil organisms and microbes of 600 mg/kg (Efroymson et al. 1997b). It is important to note that the typical range of aluminum in soils is reported to be between 10,000 and 300,000 mg/kg (EPA 2000), which are well above the maximum concentration at the site. Analysis of ecotoxicity data for aluminum from a wide variety of sites was conducted for the recent development of EPA's Draft Ecological Soil Screening Level Guidance (Draft Eco-SSL) (EPA 2000). This data suggests that aluminum is only soluble and therefore bioavailable at soil pH values less than 5.5. In soils with pH above 5.5, aluminum is probably not a contaminant of concern. Site-specific soil pH measurements were not conducted on the site; however, information from the Duval County Soil Survey (USDA 1989) indicates that soils on the site may have pHs below 5.5. In reference samples collected in the area, the concentration of aluminum ranged from 400 to 2,700 mg/kg. Only eighteen soil samples exceeded the reference range of aluminum at the site. Given all this information, aluminum may be a widespread contaminant of potential concern and is retained as a final COPEC.

Antimony was detected in 26 of 86 samples at concentrations ranging from 0.52 to 63 mg/kg. Nine of these samples exceeded the EPA Region 4 screening value of 3.5 mg/kg. These nine samples also were above the toxicity thresholds for plant of 5 mg/kg presented in Efroymson et al. (1997a)), which was selected as the refinement value. Since antimony was above a plant toxicity benchmark, it may be a widespread contaminant of potential concern and is retained as a final COPEC.

Arsenic was detected in 76 of 86 samples at concentrations ranging from 0.47 to 21 mg/kg. Four of these samples exceeded the EPA Region 4 screening value of 10 mg/kg. None of the samples were above the toxicity threshold for earthworms (60 mg/kg), which was chosen as the refinement value, or soil microbial processes (100 mg/kg). None of the samples exceeded the refinement values for direct exposure; therefore, arsenic is eliminated from consideration as a final COPEC.

Barium was detected in 86 of 86 samples at concentrations ranging from 3.3 to 810 mg/kg. Nine of these samples exceeded the EPA Region 4 screening value of 165 mg/kg. Four of these samples were also above the plant toxicity threshold of 500 mg/kg presented in Efroymson et al. (1997a), which was chosen as the refinement value; however, all were below the toxicity threshold for soil microbial processes of 3,000 mg/kg (Efroymson et al. 1997b). Only four locations contained barium at concentrations above the refinement value and the maximum HQ was relatively low. In reference samples collected in the area, the concentration of barium ranged from 3.4 to 64 mg/kg. Since barium was only slightly above the refinement value in 4 of 86 samples, it was eliminated as a contaminant of potential concern.

Cadmium was detected in 80 of 86 samples at concentrations ranging from 0.095 to 8.7 mg/kg. Thirteen of these samples exceeded the EPA Region 4 screening value of 1.6 mg/kg. None of these samples were above the toxicity thresholds for earthworms (20 mg/kg) and soil microbial processes (20 mg/kg), which was selected as the refinement value. Analysis of ecotoxicity data for cadmium from a wide variety of sites was conducted for the recent development of EPA's Draft Ecological Soil Screening Level Guidance (Draft Eco-SSL) (EPA 2000). The Draft Eco-SSL identified a plant toxicity threshold of 29 mg/kg for soil. The Draft Eco-SSL identified a soil invertebrate toxicity threshold of 110 mg/kg for soil. None of the samples exceeded the Draft Eco-SSLs for direct exposure to soils. In reference samples collected in the area, the concentration of cadmium ranged from 0.086 to 0.22 mg/kg. Since cadmium was below the Draft Eco-SSLs more recently developed, it will not be considered to be a contaminant of potential concern for direct exposure. Since cadmium was below the refinement value, it was not considered to be a COPEC for direct exposure.

Chromium was detected in all 86 samples at concentrations ranging from 1.3 to 81 mg/kg. All of these samples exceeded the EPA Region 4 screening value and the plant toxicity threshold (Efroymson et al. 1997a) of 0.4 mg/kg. Studies conducted by van Gestel et al. (1992 and 1993) on the effects of chromium and other metals, identified a no-observed-

adverse-effect-concentration for chromium in soil of 32 mg/kg, which was selected as the refinement value. Only three locations contained chromium at concentrations above the refinement value and the maximum HQ was relatively low. In reference samples collected in the area, the concentration of chromium ranged from 1.7 to 18 mg/kg. Only twelve soil samples exceeded the reference range of chromium at the site. Since only three locations contained chromium at concentrations above the refinement values and the HQs of these samples were relatively low, chromium was eliminated as a COPEC for direct exposure.

Copper was detected in all 86 samples at concentrations ranging from 1.6 to 460 mg/kg. Nineteen of these samples exceeded the EPA Region 4 screening value of 40 mg/kg. Analysis of ecotoxicity data for copper from a wide variety of sites was conducted for the recent development of EPA's Draft Eco-SSL (EPA 2000). The Draft Eco-SSL identified a soil invertebrate toxicity threshold of 61 mg/kg for soil, which was selected as the refinement value. Fifteen of the samples exceeded the Draft Eco-SSLs for soil invertebrate toxicity based on direct exposure to soils. In reference samples collected in the area, the concentration of copper ranged from 0.98 to 25 mg/kg. Since copper was above the refinement value at several locations, it may be a widespread contaminant of potential concern and is retained as a final COPEC.

Iron was detected in all 86 samples at concentrations ranging from 260 to 110,000 mg/kg, all of which are above the EPA Region 4 screening value of 200 mg/kg. The EPA Region 4 screening value is based on toxicity data for soil microbial processes presented in Efroymson et al. (1997b). There is no plant or earthworm toxicity data available for iron. EPA Region 4 has indicated that iron toxicity is related to solubility and is generally only bioavailable at low soil pH values. In soils with high pH, iron is probably not a contaminant of concern. Site-specific soil pH measurements were not conducted on the site; however, information from the Duval County Soil Survey (USDA 1989) indicates that soils on the site may have pHs below 5.5. In reference samples collected in the area, the concentration of iron ranged from 340 to 3,400 mg/kg. Thirty-six soil samples exceeded the reference range of iron at the site. Given all this information, iron may be a widespread contaminant of potential concern and is retained as a final COPEC.

Lead was detected in all 89 samples at concentrations ranging from 5.4 to 43,000 mg/kg (lead screened using XRF was not included as risk assessment data). Fifty-eight of these samples exceeded the EPA Region 4 screening value and the plant toxicity threshold (Efroymson et al. 1997a) of 50 mg/kg. Ten of these samples were above the toxicity thresholds for earthworms (500 mg/kg), which was chosen as the refinement value, and four

were above the toxicity threshold for soil microbial processes (900 mg/kg). In reference samples collected in the area, the concentration of lead ranged from 7.9 to 105 mg/kg. Since lead was above the refinement value at several locations, it may be a widespread contaminant of potential concern and is retained as a final COPEC.

Manganese was detected in all 86 samples at concentrations ranging from 4 to 760 mg/kg. Eighteen of these samples exceeded the EPA Region 4 screening value of 100 mg/kg. Only one of these samples (BDSB097) was above the toxicity thresholds for plants (500 mg/kg), which was selected as the refinement value. In reference samples collected in the area, the concentration of manganese ranged from 2.8 to 28 mg/kg. Since manganese was only slightly above the refinement value at one location, it was not retained as a final COPEC.

Nickel was detected in 79 of 86 samples at concentrations ranging from 0.52 to 54 mg/kg. Only one of these samples, BDSB097, exceeded the EPA Region 4 screening value of 30 mg/kg. None of the samples were above the toxicity thresholds for earthworms (200 mg/kg), which was chosen as the refinement value, or the toxicity threshold for soil microbial processes (90 mg/kg) (Efroymson et al. 1997b). In reference samples collected in the area, the concentration of nickel ranged from 0.56 to 9.9 mg/kg. Only one sample, BDSB097, exceeded screening thresholds for direct exposure. Since nickel was below refinement values it was not retained as a final COPEC.

Silver was detected in 17 of 86 samples at concentrations ranging from 0.2 to 5.1 mg/kg. Only one of these samples (BDSB097) exceeded the EPA Region 4 screening value and plant toxicity threshold (Efroymson et al. 1997a) of 2 mg/kg. Seed germination tests on corn, lettuce, oat, soybean, spinach, and Chinese cabbage indicated no effects on germination at concentrations of silver as high as 100 mg/kg in soil, except for Chinese cabbage, which was adversely affected by 10 mg/kg of silver in soil (Eisler 1996). Earthworms (*L. terrestris*) exposed to artificial soils amended with Ag2S for 28 days responded with reduced growth at a LOEC of 62 mg/kg of silver (Ewell et al. 1993). No bioaccumulation was observed in the 28-day test. A refinement value of 10 mg/kg was chosen for protection of sensitive plant species. None of the samples contained silver at concentrations above the refinement value. Silver was not detected in reference samples collected in the area. Since silver was below refinement values it was not retained as a final COPEC.

Vanadium was detected in all 86 samples at concentrations ranging from 1.8 to 85 mg/kg, all but one of which exceeded the EPA Region 4 screening value of 2 mg/kg. A refinement

value of 130 mg/kg was selected based on the Canadian Guidelines for Soil Quality. None of the samples contain vanadium at concentrations exceeding the refinement value. In reference samples collected in the area, the concentration of vanadium ranged from 1.4 to 6.5 mg/kg. Since vanadium was below the refinement value, it was not retained as a final COPEC

Zinc was detected in all 86 samples at concentrations ranging from 5.8 to 5,200 mg/kg. Seventy of these samples exceeded the EPA Region 4 screening value of 50 mg/kg. Twenty-four of these samples also were above the toxicity thresholds for earthworms of 200 mg/kg presented in Efroymson et al. (1997b), which was chosen as the refinement value. Forty-five of these samples were above the toxicity thresholds for soil microbial processes (100 mg/kg) (Efroymson 1997b). In reference samples collected in the area, the concentration of zinc ranged from 5 to 110 mg/kg. Since zinc was above the refinement value at several locations, it may be a widespread contaminant of potential concern and is retained as a final COPEC

Mercury was detected in 84 of 86 samples at concentrations ranging from 0.004 to 15 mg/kg. Twenty-seven of these samples exceeded the EPA Region 4 screening value of 0.1 mg/kg. A plant toxicity threshold of 0.3 was selected as the refinement value (Efroymson et al. 1997b). Seven of these samples were above the toxicity thresholds for plants (0.3 mg/kg); however, none were above the toxicity threshold for soil microbial processes (30 mg/kg). Since mercury was above the refinement value at several locations, it may be a widespread contaminant of potential concern and is retained as a final COPEC.

Cyanide was detected in 54 of 86 samples at concentrations ranging from 0.06 to 2.4 mg/kg. Twenty-four of these samples exceeded the EPA Region 4 screening value of 0.9 mg/kg for free cyanide. However, when compared to the EPA Region 4 screening value for cyanide in complex (5 mg/kg), which was chosen as the refinement value, none of the samples exceed the screening value. Cyanide was not detected in reference soil samples. The fate of cyanide in soils is pH dependant and may occur as hydrogen cyanide, alkali metal salts, or as immobile metallocyanide complexes. In soil, any free cyanide (as hydrogen cyanide) present would tend to volatilize or be rapidly biodegraded by bacteria; therefore, most cyanide in soil would tend to be metallocyanide complexes (ATSDR 1993). Based on this information, the refinement value for the cyanide complex would be a more appropriate toxicity benchmark. Since cyanide did not exceed the refinement toxicity thresholds in any samples, it was eliminated as a COPEC.

3.1.1.3. Pesticides. *Pesticides are not eliminated based on reference concentrations* since, in every case, the pesticides levels detected on the site are significantly greater than reference concentrations for the same pesticides. In addition, it is important to note that these contaminants may be accumulated in biological tissue and could also present a food chain exposure risk.

Aldrin was detected in only 1 of 19 samples (BDSB012) at a concentrations of 160 ug/kg. This concentration exceeds the EPA Region 4 screening value of 2.5 ug/kg. There were no available toxicity values to derive a refinement value for direct exposure. Only one sample, BDSB012, exceeded screening thresholds for direct exposure. Since aldrin was above toxicity benchmarks at this location, it may be a contaminant of potential concern at a hot spot. However, it is not a widespread contaminant of concern and was eliminated as a COPEC on the basis of a low frequency of occurrence.

Alpha-chlordane was detected in 2 of 19 samples at concentrations ranging from 79 to 200 ug/kg. One sample (BDSB088) contained alpha-chlordane at concentrations exceeding the EPA Region 4 screening value of 100 ug/kg. There were no available toxicity values to derive a refinement value for direct exposure. Only one sample, BDSB088, exceeded screening thresholds for direct exposure. Since alpha-chlordane was above toxicity benchmarks at this location, it may be a contaminant of potential concern at a hot spot. However, it is not a widespread contaminant of concern and was eliminated as a COPEC on the basis of a low frequency of occurrence and a low magnitude of exceedance.

Dieldrin was detected in 1 of 19 samples at concentrations of 100 ug/kg. Only one sample, BDSB088, exceeds the EPA Region 4 screening value of 0.5 ug/kg. There were no available toxicity values to derive a refinement value for direct exposure. Since dieldrin was above toxicity benchmarks at this location, it may be a contaminant of potential concern at a hot spot. However, it is not a widespread contaminant of concern and was eliminated as a COPEC on the basis of a low frequency of occurrence.

Gamma-chlordane was detected in only 4 of 19 samples at a range of 0.46 to 460 ug/kg; however, only two samples (BDSB012 and BDSB088) contained concentrations (460 and 160 ug/kg, respectively) that exceeded the EPA Region 4 screening value of 100 ug/kg. There were no available toxicity values to derive a refinement value for direct exposure. Gamma-chlordane was detected in reference samples at a range of 0.59 to 32 ug/kg. Since gamma-chlordane was above toxicity benchmarks at these locations, it may be a contaminant of potential concern at a hot spot. However, it is not a widespread contaminant

of concern and was eliminated as a COPEC on the basis of a low frequency of occurrence and a low magnitude of exceedance.

4,4'-DDD (DDD) was detected in only 1 of 19 samples (BDSB182) at a concentration of and 44 J ug/kg. This concentration exceeds the EPA Region 4 screening value of 2.5 ug/kg. It is important to note that all samples with DDD are below the EPA Region 5 RCRA EDQL of 758.15 ug/kg (EPA 1999b) and the EC ecological criteria of 700 ug/kg (CCMOE 1999b), which was chosen as the refinement value. DDD was not detected in reference samples collected in the area. Although DDD exceeded the EPA screening value it was below other measures of ecological toxicity and is therefore eliminated as a COPEC for direct exposure.

4,4'-DDE (DDE) was detected in only 3 of 19 samples at a range of 26 to 380 ug/kg. All three of these samples exceeded the EPA Region 4 screening value of 2.5 ug/kg. It is important to note that all samples with DDE are below the EPA Region 5 RCRA EDQL of 595.87 ug/kg (EPA 1999b) and the EC ecological criteria of 700 ug/kg (CCMOE 1999a), which was chosen as the refinement value. DDE was detected in 2 of 14 reference soil samples at concentrations 3.1 and 3.6 ug/kg. The samples in which DDE has been detected also contained DDD. Although DDE exceeded the EPA screening value it was below other measures of ecological toxicity and is therefore eliminated as a COPEC for direct exposure.

4,4'-DDT (DDT) was detected in only 4 of 19 samples at a range of 20 to 1,000 ug/kg. All four of these samples exceeded the EPA Region 4 screening value of 2.5 ug/kg. It is important to note that 4,4'-DDT is above the EPA Region 5 RCRA EDQL of 17.5 ug/kg, which was chosen as the refinement value. DDT was detected in 4 of 14 reference soil samples at concentrations ranging from 1.9 to 49 ug/kg. The samples in which DDT has been detected also contained DDD and DDE. DDT is not a widespread contaminant and is unlikely to be toxic to earthworms or to impair populations of soil microfauna at the Brown's Dump Site based on maximum concentrations observed (Callahan et al., 1991; Megharaj et al., 2000) Hence DDT was eliminated as a direct exposure COPEC. DDT (and all the pesticides listed above) will be further evaluated for food-chain exposure in Section 3.2.

3.1.1.4. Polychlorinated Biphenyls (PCBs). PCBs are not eliminated from consideration based on reference concentrations since in every case, the PCB levels detected on the site are significantly greater than reference concentrations for the same PCBs. In addition, PCBs are not expected to be naturally present in surface soil at the site.

Aroclor-1260 was detected in 7 of 19 samples at concentrations ranging from 6.6 J to 260 ug/kg. Four of these samples exceed the EPA Region 4 screening value of 20 ug/kg. None of these locations contain Aroclor-1260 at concentrations greater than the plant toxicity threshold of 40,000 ug/kg (Efroymson 1997a). It is important to note that Aroclor-1260 is above the EPA Region 5 RCRA EDQL of 0.332 ug/kg (EPA 1999) but below the EC ecological criteria of 1,300 ug/kg (CCMOE 1999b), which was chosen as the refinement value. Aroclor-1260 was not detected in reference samples collected in the area. Since Aroclor-1260 was below the refinement value, it was eliminated as a final COPEC.

3.1.1.5. Semivolatile Organic Compounds (SVOCs). SVOCs are not be eliminated from consideration based on reference concentrations since in every case, the SVOC levels detected on the site are significantly greater than reference concentrations for the same SVOCs. In addition, SVOCs are not expected to be naturally present in surface soil at the site. SVOCs identified as PCOPEC in surface soils were all polycyclic aromatic hydrocarbons (PAHs). Refinement values were not available for specific PAHs; however, a study by Erstfeld and Snow-Ashbrook (1999) identified no adverse effects on soil invertebrate communities at concentrations as high as 5.28 mg/kg of total PAHs. Hence, a refinement value of 5,000 ug/kg for total PAHs was chosen for the ERA. None of the samples contained the six PAH compounds at total concentrations exceeding 5,000 mg/k. Two samples (BDSB045 and BDSB058) contained all PAHs at concentrations of 5,129 and 6,320, respectively. Since the frequency of detection for these contaminants above the refinement values was low and the magnitude of exceedance was also low, PAHs as a group were eliminated as COPEC.

3.1.2 Sediment

A large number of contaminants were identified as PCOPEC in sediment during the initial screening as presented in Table 2-7. In this refinement, these PCOPEC were initially compared to the selected ERVs as shown in Table 2-5. The ERVs were selected in conjunction with EPA Region 4. The order of preference in selecting the sediment ERVs was developed on the basis of the similarity of the test organisms to the site environment, the general acceptability of the data within the scientific community, and the use of the ERVs by other regulatory bodies.

In selecting these sediment ERVs, the more conservative of the probable effect levels (PEL) presented by the Florida Department of Environmental Protection (FDEP) and the Canadian

Sediment Quality Guidelines were selected. These two sources of sediment toxicity data are based largely on freshwater sediment toxicity studies and are indicative of the most likely thresholds for effects. Next in level of preference were toxicity values selected for threshold effect-type of levels, first in freshwater sediments and then in marine sediments. The last level of preference was toxicity values selected for severe or high effect levels (because these are the least conservative) first in freshwater sediments and then in marine sediments. The detailed order of preference for selecting sediment ERVs is as follows:

The more conservative toxicity values presented by:

1. FDEP, 2000. Florida Department of Environmental Protection. Approach to the Assessment of Sediment Quality in Florida Coastal Water, Volume 1 – Development and Evaluation of Sediment Quality Assessment Guidelines, November 1994. - PEL Values.
2. CCMOE, 1999a. Canadian Council of Ministers of the Environment, Canadian Environmental Quality Guidelines, Canadian Sediment Quality Guidelines for the Protection of Environmental and Human Health – Summary Tables, 1999 - PEL Values.

Then, in order of preference:

3. Persaud et al., 1990. Persaud, D., Jaagumagi, R., and Hayton, A., The Provincial Sediment Quality Guidelines, Ontario Ministry of the Environment, 1990 -Low Effect Values.
4. EPA 1996. Eco Update (Ecotox Thresholds). Interim Bulletin Volume 3, Number 2. EPA 540/f-95/038, January 1996 - Freshwater Sediment Values.
5. Long et al., 1995. Long, E.R., MacDonald, D.D., Smith, S.L., and Calder, F.D., "Incidence of Adverse Biological Effects within Ranges of Chemical Concentrations in Marine and Estuarine Sediments", submitted to Environmental Management, October 15, 1993. - ER-L Values.
6. FDEP, 2000. Florida Department of Environmental Protection. Approach to the Assessment of Sediment Quality in Florida Coastal Water, Volume 1 – Development and Evaluation of Sediment Quality Assessment Guidelines, November 1994. - TEL Values.
7. CCMOE, 1999a. Canadian Council of Ministers of the Environment, Canadian Environmental Quality Guidelines, Canadian Sediment Quality Guidelines for the Protection of Environmental and Human Health – Summary Tables, 1999 - ISQG Values.

8. Persaud et al., 1990. Persaud, D., Jaagumagi, R., and Hayton, A., The Provincial Sediment Quality Guidelines, Ontario Ministry of the Environment, 1990 - Severe Effect Values.
9. EPA 1996. Eco Update (Ecotox Thresholds). Interim Bulletin Volume 3, Number 2. EPA 540/f-95/038, January 1996 – Marine Sediment Values.
10. Long et al., 1995. Long, E.R., MacDonald, D.D., Smith, S.L., and Calder, F.D., "Incidence of Adverse Biological Effects within Ranges of Chemical Concentrations in Marine and Estuarine Sediments", submitted to Environmental Management, October 15, 1993. - ER-M Values.
11. MHSPE, 2000. Ministry of Housing, Spatial Planning and Environment, Directorate General for Environmental Protection, Department of Soil Protection, Dutch Soil/Sediment Cleanup Standards, The Netherlands, 2000.
12. Other chemical-specific toxicological reference values.

3.1.2.1. Inorganics. Several of the inorganic PCOPEC are essential nutrients effectively bio-regulated by most organisms. As a result, ecological toxicity data for these nutrients (calcium, magnesium, and potassium) are lacking due to a general lack of significant concern. It is highly unlikely that these constituents present significant ecological risk and they should not drive future investigations on the site since they are not overtly related to suspected source constituents. Based on this information and the lack of a suspected source of these constituents, these compounds were eliminated as COPEC.

There were no refinement values for aluminum and vanadium due to a lack of available toxicological data defining the effects of these metals on benthic invertebrates. Given the lack of data for benthic invertebrates, the sediment concentrations were compared to the refinement values used for soil (terrestrial invertebrates). Based on this comparison aluminum and vanadium were eliminated as COPEC.

Barium was detected in all 13 sediment samples at concentrations ranging from 2.7 to 17 mg/kg. The range of barium in reference samples was 2.6 to 22 mg/kg. There was no EPA Region 4 sediment screening value for barium. A refinement value for barium of 200 mg/kg was established based on the Dutch Soil/Sediment Cleanup Standards (MHSPE, 2000). Since the maximum concentration of barium in sediments at the site was well below the refinement value, barium was not retained as a COPEC.

Iron was detected in all 13 sediment samples at concentrations ranging from 380 to 3,100 mg/kg. The range of iron in reference samples was 280 to 14,000 mg/kg. There was no

EPA Region 4 sediment screening value for iron. A refinement value for iron of 20,000 mg/kg was established based on the Canadian Sediment Quality Guideline - ISQG values (CCMOE 1999). Since the maximum concentration of iron in sediments at the site was well below the refinement value, iron was not retained as a COPEC.

Manganese was detected in all 13 sediment samples at concentrations ranging from 2.8 to 34 mg/kg. The range of manganese in reference samples was 1.2 to 740 mg/kg. There was no EPA Region 4 sediment screening value for manganese. A refinement value for manganese of 460 mg/kg was established based on the Ontario Ministry of the Environment Sediment Quality Guidelines – Low Effect Values (Persaud et al. 1990). Since the maximum concentration of manganese in sediments at the site was well below the refinement value, manganese was not retained as a COPEC.

Lead was detected in all 13 sediment samples at concentrations ranging from 4.9 to 46 mg/kg. The range of lead in reference samples was 3.8 to 21 mg/kg. All three sediment samples from Moncrief Creek collected downgradient of the site, north and east of the railroad culvert, contained lead at concentrations (40 to 46 mg/kg) exceeding the EPA Region 4 sediment screening value. A refinement value for lead of 91.3 mg/kg was established based on the Canadian Sediment Quality Guideline – PEL values (CCMOE 1999). Since the maximum concentration of lead in sediments at the site was below the refinement value, lead was not retained as a COPEC.

3.2.1.3. Pesticides. The pesticides identified as PCOPEC (alpha-chlordane, gamma-chlordane, DDE, and DDT) are not eliminated based on reference concentrations. Alpha- and gamma-chlordane were both detected in reference samples.

Alpha-chlordane was detected in 6 of 13 sediment samples at concentrations of 0.42 to 0.78 ug/kg. Only one sediment sample, BDSW007, contained alpha-chlordane at concentrations exceeding the EPA Region 4 sediment screening value. A refinement value of 4.79 was established based on the Florida Sediment Quality Attainment Goals – PEL values (FDEP 2000). Since the maximum concentration of alpha-chlordane in sediments at the site is below the refinement value, alpha-chlordane was not retained as a COPEC.

Gamma-chlordane was detected in 6 of 13 sediment samples at concentrations of 0.44 to 1.5 ug/kg. Only two sediment samples, BDSW005 and BDSW007, contained gamma-chlordane at concentrations exceeding the EPA Region 4 sediment screening value. A refinement value of 4.79 was established based on the Florida Sediment Quality Attainment Goals –

PEL values (FDEP 2000). Since the maximum concentration of gamma-chlordane in sediments at the site is below the refinement value, gamma-chlordane was not retained as a COPEC.

4,4'-DDE was detected in only 2 of 13 sediment samples at concentrations of 0.42 and 2.1 ug/kg. Only one sediment sample, BDSW006, contained DDE at concentrations exceeding the EPA Region 4 sediment screening value. A refinement value of 6.75 was established based on the Canadian Sediment Quality Guideline - PEL values (CCMOE 1999). Since the maximum concentration of DDE in sediments at the site is below the refinement value, DDE was not retained as a COPEC.

4,4'-DDT was detected in only 1 of 13 sediment samples (BDSW006) at a concentrations of 5 ug/kg which also exceeded the EPA Region 4 sediment screening value. A refinement value of 4.77 was established based on the Canadian Sediment Quality Guideline - PEL values (CCMOE 1999) and the Florida Sediment Quality Attainment Goals – PEL values (FDEP 2000). Since the maximum concentration of DDT in sediments at the site is below the refinement value, DDT was not retained as a COPEC.

3.2.1.4. Semivolatile Organic Compounds (SVOCs). SVOCs are not be eliminated from consideration based on reference concentrations since in every case, the SVOC levels detected near the site are significantly greater than reference concentrations for the same SVOCs.

Benzo(a)anthracene was detected in only 4 of 13 sediment samples at concentrations of 32 to 75 ug/kg. It was also detected in one reference sample at a concentration of 45 ug/kg. Only one sediment sample, BDSW006, contained benzo(a)anthracene at concentrations exceeding the EPA Region 4 sediment screening value. A refinement value of 385 was established based on the Canadian Sediment Quality Guideline - PEL values (CCMOE 1999). Since the maximum concentration of benzo(a)anthracene in sediments at the site is below the refinement value, benzo(a)anthracene was not retained as a COPEC.

Pyrene was detected in only 3 of 13 sediment samples at concentrations of 89 to 180 ug/kg. It was also detected in one reference sample at a concentration of 95 ug/kg. Only one sediment sample, BDSW006, contained pyrene at concentrations exceeding the EPA Region 4 sediment screening value. A refinement value of 875 was established based on the Canadian Sediment Quality Guideline - PEL values (CCMOE 1999). Since the maximum

concentration of pyrene in sediments at the site is below the refinement value, pyrene was not retained as a COPEC.

Based on this information, there were no contaminants observed in sediment that were retained as COPEC. As a result, this ERA concludes that sediment is not a media of concern for direct exposure to ecological receptors in Moncrief Creek.

3.1.3 Surface Water

Several inorganics were identified as PCOPEC in surface water during the initial screening as presented in Table 2-7. In this refinement, these PCOPEC were initially compared to the approved ERVs as shown in Table 2-6. The ERVs were selected in conjunction with EPA Region 4. The order of preference in selecting the surface water ERVs was developed on the basis of the similarity of the test organisms to the site environment, the general acceptability of the data within the scientific community, and the use of the ERVs by other regulatory bodies.

In selecting these surface water ERVs, the more conservative of the lowest chronic values (LCVs) was selected as presented by Suter and Tsao (1996) for surface water toxicity. These LCVs are the lowest levels of a particular contaminant (without adjustment factors) shown to present adverse effects to the tested organisms. Based on the broad availability of data and the diversity of studies from which the LCVs were drawn, the most conservative LCV for all tested organisms were selected as the ERVs. The next level of preference was the comparison of maximum detections (on site) to toxicity values based on the Florida Surface Water Quality Guidelines followed by the comparison to EPA-developed toxicological values based on freshwater systems. After this, the other regulatory guidelines of non-EPA agencies were considered. As the last level of preference, values selected for marine waters were considered. The detailed order of preference for selecting surface water ERVs is as follows:

The more conservative toxicity values presented by:

1. Suter and Tsao, 1996. Suter II, G.W., and Tsao, C.L., Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Aquatic Biota: 1996 Revision, U.S. Department of Energy - Table 1. Lowest Chronic Values for Fish.
2. Suter and Tsao, 1996. Suter II, G.W., and Tsao, C.L., Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Aquatic Biota: 1996

Revision, U.S. Department of Energy - Table 1. Lowest Chronic Values for Daphnids.

3. Suter and Tsao, 1996. Suter II, G.W., and Tsao, C.L., Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Aquatic Biota: 1996 Revision, U.S. Department of Energy - Table 1. Lowest Chronic Values for Non-Daphnid Invertebrates.
4. Suter and Tsao, 1996. Suter II, G.W., and Tsao, C.L., Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Aquatic Biota: 1996 Revision, U.S. Department of Energy - Table 1. Lowest Chronic Values for Aquatic Plants.

Then, in order of preference:

5. FDEP, 2000. Florida Department of Environmental Protection, Florida Administrative Code, Chapter 62-302 Surface Water Quality Standards - Freshwater Values.
6. EPA 1996. Eco Update (Ecotox Thresholds). Interim Bulletin Volume 3, Number 2. EPA 540/f-95/038, January 1996 - Freshwater Surface Water Values.
7. EPA 1999. U.S. Environmental Protection Agency, Office of Water. National Ambient Water Quality Criteria - Correction. EPA822-Z-99-001. April 1999. Freshwater CCC.
8. EPA 1993. Water Quality Guidance for the Great Lakes System and Correction: Proposed Rules. Federal Register. 58(72):20802-21047.
9. CCMOE, 1999c. Canadian Council of Ministers of the Environment, Canadian Environmental Quality Guidelines, Canadian Water Quality Guidelines for the Protection of Aquatic Life – Summary Tables, 1999 - Freshwater Values.
10. FDEP, 2000. Florida Department of Environmental Protection, Florida Administrative Code, Chapter 62-302 Surface Water Quality Standards - Marine Values.
11. EPA 1996. Eco Update (Ecotox Thresholds). Interim Bulletin Volume 3, Number 2. EPA 540/f-95/038, January 1996 - Marine Surface Water Values.
12. EPA 1999. U.S. Environmental Protection Agency, Office of Water. National Ambient Water Quality Criteria - Correction. EPA822-Z-99-001. April 1999. Saltwater CCC.
13. CCMOE, 1999c. Canadian Council of Ministers of the Environment, Canadian Environmental Quality Guidelines, Canadian Water Quality Guidelines for the Protection of Aquatic Life – Summary Tables, 1999 - Marine Values.

PCOPEC were evaluated to determine if the essential nutrients (calcium, magnesium, potassium, and sodium) could be eliminated on the basis of low toxicity. Since the levels of these essential nutrients were within the generally accepted tolerance levels for most organisms (as shown in Table 2-6), these essential nutrients were eliminated as COPEC in surface water at the site.

Manganese was detected in 12 of the 13 samples collected at concentrations of 0.021 to 0.04 mg/L and the dissolved form was detected in 11 (filtered) samples at concentrations of 0.019 to 0.038 mg/L. There was no EPA Region 4 screening value for manganese. A refinement value of 1.1 was established based on the lowest chronic value for aquatic organisms (daphnids) reported by Suter & Tsao (1996). Concentrations of manganese in reference samples ranged from non-detect to 0.036 mg/L. Since the maximum concentration of manganese in surface waters at the site is below the refinement value, manganese was not retained as a COPEC.

Cyanide was detected in 5 of the 13 samples collected at concentrations of 0.0055 to 0.013 mg/L. Three samples contained cyanide at levels greater than the EPA Region 4 screening value of 0.0052 mg/L. A refinement value of 0.0078 was established based on the lowest chronic value for aquatic organisms (fish) reported by Suter & Tsao (1996). Concentrations of cyanide in reference samples ranged from non-detect to 0.0054 mg/L. One sample (BDSW002) slightly exceeded the refinement value for cyanide; however, since the magnitude of this exceedance was minor (HQ = 1.67) and only one sample exceeded the refinement value, cyanide was not retained as a COPEC.

Based on this information, there were no contaminants observed in surface water that were retained as COPEC. As a result, this ERA concludes that surface water is not a media of concern for direct exposure to ecological receptors in Moncrief Creek.

3.2 Refinement of PCOPEC for Food Chain Exposure

The refinement of PCOPEC to determine COPEC through food chain exposure is based on a comparison of ingestion doses through the food chain to toxicological reference doses for important bioaccumulative compounds, as identified by EPA (2000). Ingestion doses were based on both the average and maximum concentrations of each important bioaccumulative compounds and were determined by the following equation derived from EPA's Wildlife Exposure Factors (EPA, 1993):

$$ADD = [C_{PF} * FD_{PF} * AUF * NFIR_{adj}] \quad \text{(dose from prey)}$$
$$+ [C_m * AUF * NSIR] \quad \text{(dose from incidental soil ingestion)}$$

Where:

ADD	=	Average daily dose (mg/kgBW-day)
C_{PF}	=	Estimated concentration of contaminant in prey (mg/kg)
C_m	=	Concentration of contaminant in media (mg/kg)
NFIR	=	Normalized food ingestion rate (g/gBW-day)
$NFIR_{adj}$	=	NFIR less NSIR (g/gBW-day)
NSIR	=	Normalized incidental soil/sediment ingestion rate (g/gBW-day)
FD_{PF}	=	Dietary fraction comprised of item (assume 100%)
AUF	=	Area usage factor of receptor species (assume 100% usage)

- It is important to note that NFIR was not adjusted in the food chain exposure model for sediment since the ingestion rate for the receptor exposed to sediment (snowy egret) was estimated independent of sediment ingestion.

The average daily dose for each important bioaccumulative compounds detected at the site was calculated based on the average and maximum detected concentrations. The resultant average and maximum doses were compared to no-observed-adverse-effect-levels (NOAEL) and low-observed-adverse-effect-levels (LOAEL) for mammals and birds obtained from the literature. These NOAELs and LOAELs, considered toxicological reference values (TRV) for wildlife, were compiled from a variety of sources in the scientific literature in conjunction with EPA Region 4. In general, most of the TRVs were obtained from the U.S. Department of Energy's "*Toxicological Benchmarks for Wildlife*" (Sample et al. 1996). In selecting TRVs for contaminants with multiple studies in this reference, reproductive affects were the preferred endpoints, and dietary ingestion was the preferred exposure route. An approved list of wildlife TRVs is presented in Table 3-2.

Eight HQs were developed for each detected important bioaccumulative compound based the following calculations:

- ADD average / NOAEL bird
- ADD maximum / NOAEL bird
- ADD average / LOAEL bird

- ADD maximum / LOAEL bird
- ADD average / NOAEL mammal
- ADD maximum / NOAEL mammal
- ADD average / LOAEL mammal
- ADD maximum / LOAEL mammal

When a contaminant was present at concentrations that produced an HQ greater than one based on the average ADD and either bird or mammal LOAELs, that contaminant was considered to be a food chain COPEC. Contaminants with HQs greater than one based on maximum ADD and other TRVs (NOAELs or LOAELs) were considered on a case by case basis for inclusion as COPEC.

In evaluating the terrestrial environment, surface soils were considered as the substrate medium. When evaluating the aquatic environment, sediments were considered to be the substrate medium. Surface water was not evaluated as a substrate media for food chain exposure because it represents a minor exposure pathway to wildlife.

3.2.1 Surface Soil

A large number of contaminants were identified as PCOPEC in surface soil during the initial screening as presented in Table 2-7. Several of these contaminants are indicated to be important bioaccumulative compounds by EPA including: arsenic, cadmium, chromium, lead, nickel, silver, zinc, mercury, aldrin, alpha-chlordane, dieldrin, gamma-chlordane, 4,4'-DDD, 4,4'-DDE, 4,4'-DDT, Aroclor-1260, anthracene, benzo(a)pyrene, fluoranthene, phenanthrene, and pyrene.

The food chain exposure model presented previously was used to evaluate the exposure to, and risk from, food chain transfer of important bioaccumulative compounds. Based on the site conditions and preliminary ecological exposure model, there are three principal receptor communities that could be exposed to bioaccumulative contaminants at the site which includes terrestrial vermivores, herbivores, and carnivores.

3.2.1.1. Food Chain Exposure to Vermivores. The vermivore community was selected as an important community to evaluate using the FCM based on the potential exposure pathway where bioaccumulative PCOPEC are incorporated into the tissue of earthworms and the earthworm is ingested by a vermivore. The robin was used as a surrogate species to represent all birds that feed on insect at the site. The robin serves as a

model of an insectivorous bird and as representative receptor of the soil-to-invertebrate-to-vermivore pathway. The robin uses the type of urban habitat (abandoned fields and lawns) found on the site, is largely dependant on earthworms as a prey source, and may incidentally ingest a relatively large amount of soil. Given these characteristics the robin probably maximizes the exposure potential for a vermivore in an urban habitat.

To determine the food chain exposure of soil contaminants to typical vermivore, it is necessary to determine the concentration of bioaccumulative compounds in the tissues of the vermivore prey species (e.g. earthworms). The potential for biotransfer from the surface soil to an earthworm is represented in this ERA using a soil-to-earthworm biotransfer factor (BTF). Soil-to-earthworm BTFs were developed in conjunction with EPA Region 4 and are presented in Table 3-3. The average and maximum soil concentration, multiplied by the appropriate approved BTF was used to estimate the concentration of bioaccumulative compounds in earthworm tissue. The estimated ADD to vermivores (using the robin as a surrogate), based on the average and maximum soil concentrations, is presented in Table 3-4. Values for the various exposure model variables used to estimate ADD are also provided on Table 3-4.

The average and maximum ADD for terrestrial vermivores (using the robin as a surrogate), was compared to the wildlife TRVs (as presented previously) to derive an range of HQs for each bioaccumulative compound. The HQs developed for the bioaccumulative compounds detected in surface soil at the site is presented in Table 3-5.

When the average ADD for a contaminant resulted in a LOAEL HQ greater than 1, the contaminant was considered to be a food chain exposure COPEC. Average concentrations of 4,4'-DDT present a LOAEL HQ greater than one for the terrestrial vermivore. 4,4'-DDT was detected in four of nineteen samples and may be associated with localized areas of contamination; therefore it was retained as COPEC for food chain exposure.

When the maximum ADD for a contaminant resulted in a LOAEL HQ greater than 1, these contaminants were considered on a case-by-case basis. Maximum concentrations of lead and zinc also presented a LOAEL HQs greater than one for the terrestrial vermivores. The rationale for including or excluding each of these additional contaminants as food chain exposure COPEC is discussed as follows:

- Lead was retained as a food chain exposure COPEC. The critical concentration of lead is 408 mg/kg. Ten samples contained lead at concentrations above this critical concentration.

- Zinc was retained as a food chain exposure COPEC. The critical concentration of zinc is 361 mg/kg. Fifteen samples contained zinc at concentrations above this critical concentration.

- Mercury was retained as a food chain exposure COPEC. Mercury was unique in that there was significant variability in its bioavailability as related to its chemical form. For example, mercuric chloride (used in the Human Health Risk Assessment) has a BAF of 0.04, whereas methyl mercury has a BAF of 8.5. As shown in Table 3-5, this variability is significant and would indicate that mercury may or may not be a COPEC, depending on its form. The critical concentration for mercury (as methyl mercury) would be 0.012 mg/kg; however, as mercuric chloride, the critical concentration would be 1.6 mg/kg. Eighty-two samples exceed the critical concentration for methyl mercury; however, only one sample exceeds the critical concentration for mercuric chloride. Since the speciation of mercury in surface soils at the site is unknown, the more conservative BAF was used to determine that mercury should be retained as a COPEC.

Based on this evaluation, the following contaminants (also shown on Table 3-12) were considered as surface soil COPEC for food chain exposure to vermivores:

- 4,4'-DDT
- Lead
- Zinc
- Mercury

3.2.1.2. Food Chain Exposure to Herbivores. The herbivore community was selected as an important community to evaluate using the FCM based on the potential exposure pathway where bioaccumulative PCOPEC are incorporated into the tissue of plants and the plant is ingested by a herbivore. A meadow vole was selected as a representative receptor of the soil-to-plant-to-herbivore pathway. The meadow vole uses the habitat (abandoned fields) found on the site, is largely dependant on grasses, sedges, and plants likely to take contaminants up from the soil, and may incidentally ingest a relatively

large amount of soil. Given these characteristics the meadow vole probably maximizes the exposure potential for a herbivore.

To determine the food chain exposure of soil contaminants to typical herbivore, it is necessary to determine the concentration of bioaccumulative compounds in the tissues of the herbivore prey species (e.g. plants). The potential for biotransfer from the surface soil to a plant is represented in this ERA using a soil-to-plant biotransfer factor (BTF). Soil-to-plant BTFs were developed in conjunction with EPA Region 4 and are presented in Table 3-6. The average and maximum soil concentration, multiplied by the appropriate approved BTF was used to estimate the concentration of bioaccumulative compounds in plant tissue. The estimated ADD to herbivores (using the vole as a surrogate), based on the average and maximum soil concentrations, is presented in Table 3-7. Values for the various exposure model variables used to estimate ADD are also provided on Table 3-7.

The average and maximum ADD for terrestrial herbivores (using the vole as a surrogate) was compared to the wildlife TRVs (as presented previously) to derive a range of HQs for each bioaccumulative compound. The HQs developed for the bioaccumulative compounds detected in surface soil at the site is presented in Table 3-8.

When the average ADD for a contaminant resulted in a LOAEL HQ greater than 1, the contaminant was considered to be a food chain exposure COPEC. Of the bioaccumulative PCOPEC detected at the site, none were present at average concentrations that presented a LOAEL HQ greater than one for terrestrial herbivores.

When the maximum ADD for a contaminant resulted in a LOAEL HQ greater than 1, these contaminants were considered on a case-by-case basis. Maximum concentrations of lead and mercury presented a LOAEL HQs greater than one for the terrestrial herbivores. The rationale for including or excluding each of these additional contaminants as food chain exposure COPEC is discussed as follows:

- Lead was eliminated as a food chain exposure COPEC. The critical concentration of lead for herbivores is 12,606 mg/kg. Only one sample (BDSB009) contained lead at concentrations above this critical concentration. Based on these observations, there does not appear to be a significant exposure risk for food chain exposure given the extremely limited distribution.

- Mercury was eliminated as a food chain exposure COPEC. The critical concentration of mercury for herbivores is 10.83 mg/kg. Only one sample (BDSB054) contained mercury at concentrations above this critical concentration. Based on these observations, there does not appear to be a significant exposure risk for food chain exposure given the extremely limited distribution.

Based on this evaluation, there were no contaminants in surface soil that were considered to be COPEC for food chain exposure to herbivores.

3.2.1.3. Food Chain Exposure to Carnivores. The terrestrial carnivore community was selected as an important community to evaluate using the FCM based on the potential exposure pathway where bioaccumulative PCOPEC are incorporated into the tissue of small animals and a carnivore ingests the small animal. A red-tailed hawk was selected as a representative receptor of the soil-to-small animal-to-herbivore pathway. The red-tailed hawk uses the habitat (abandoned fields) found on the site, is located in the region, and is likely carnivores present in the area. Given these characteristics the red-tailed hawk probably maximizes the exposure potential for a carnivore.

To determine the food chain exposure of soil contaminants to typical carnivore, it is necessary to determine the concentration of bioaccumulative compounds in the tissues of the carnivore prey species (e.g. small mammals). The potential for biotransfer from the surface soil to a small mammal is represented in this ERA using a soil-to-vertebrate biotransfer factor (BTF). Soil-to-vertebrate BTFs were developed in conjunction with EPA Region 4 and are presented in Table 3-9. The average and maximum soil concentration, multiplied by the appropriate approved BTF was used to estimate the concentration of bioaccumulative compounds in small mammal tissue. The estimated ADD to terrestrial carnivores (using the hawk as a surrogate), based on the average and maximum soil concentrations, is presented in Table 3-10. Values for the various exposure model variables used to estimate ADD are also provided on Table 3-10.

The average and maximum ADD for terrestrial carnivores (using the hawk as a surrogate) was compared to the wildlife TRVs (as presented previously) to derive a range of HQs for each bioaccumulative compound. The HQs developed for the bioaccumulative compounds detected in surface soil at the site is presented in Table 3-11.

When the average ADD for a contaminant resulted in a LOAEL HQ greater than 1, the contaminant was considered to be a food chain exposure COPEC. Of the bioaccumulative

PCOPEC detected at the site, none were present at average concentrations that presented a LOAEL HQ greater than one for terrestrial herbivores.

When the maximum ADD for a contaminant resulted in a LOAEL HQ greater than 1, these contaminants were considered on a case-by-case basis. Of the bioaccumulative PCOPEC detected at the site, only lead was present at a maximum concentration that presented a LOAEL HQ greater than one for terrestrial carnivores; however, lead was eliminated as a food chain exposure COPEC. The critical concentration of lead for carnivores is 26,723 mg/kg. Only one sample (BDSB009) contained lead at concentrations above this critical concentration. Based on these observations, there does not appear to be a significant exposure risk for food chain exposure given the extremely limited distribution.

Based on this evaluation, the there were no contaminants in surface soil that were considered to be COPEC for food chain exposure to carnivores.

3.2.2 Sediment

A large number of contaminants were identified as PCOPEC in sediment during the initial screening as presented in Table 2-7. Several of these contaminants are indicated to be important bioaccumulative compounds by EPA including: lead, alpha-chlordane, gamma-chlordane, 4,4'-DDE, 4,4'-DDT, benzo(a)anthracene, and pyrene.

The food chain exposure model presented previously was used to evaluate the exposure to, and risk from, food chain transfer of important bioaccumulative compounds. Based on the site conditions and preliminary ecological exposure model, there are two principal receptor communities (aquatic insectivores and piscivores) that could be exposed to bioaccumulative contaminants at the site. However, there is scant data for sediment-to-fish biotransfer and sediment-to-invertebrate biotransfer would be expected to be more significant given the greater exposure potential. As a result, exposure and risks to the aquatic insectivore community were used to identify food chain exposure COPEC from sediment.

3.2.2.1. Food Chain Exposure to Aquatic Insectivores. The aquatic insectivore community was selected as an important community to evaluate using the FCM based on the potential exposure pathway where bioaccumulative PCOPEC are incorporated into the tissue of aquatic insects and an aquatic insectivore ingests these insects. A snowy egret was selected as a representative receptor of the sediment-to-invertebrate-to-insectivore pathway. The snowy egret is a medium-sized wading bird that feeds in and around small streams and

lowlands. It is one of several white wading birds that may forage in McCoy's Creek and can be distinguished from great egrets, immature little blue herons, and cattle egrets by its black legs and yellow feet. The diet of the snowy egret contains a substantial portion of aquatic invertebrates (Kushlan 1978; Terres 1991). The home range of the snowy egret has been reported to be 12,434 acres (Custer and Osborn 1978) but because birds might forage in only a portion of their home range, the feeding territory size of the great blue heron (20.7 acres) (USEPA 1993) was chosen for use in the risk assessment. The available foraging habitat for the egret at the Brown's Dump Site is approximately 2 acres; therefore, a site-specific area-use factor of 0.097 was used. A body weight of 370 grams was assumed for the snowy egret (Erwin and Spendalow 1991). The normalized food ingestion rate of 0.493 grams/gram of body weight (fresh weight) was based on an allometric equation for birds reported by Nagy (1987) (USEPA 1993). An incidental ingestion rate of 5 percent was assumed since much of the diet is gleaned from probing aquatic substrates and adjacent shorelines.

To determine the food chain exposure of soil contaminants to typical aquatic insectivore, it is necessary to determine the concentration of bioaccumulative compounds in the tissues of the aquatic insectivore prey species (e.g. benthic invertebrates). The potential for biotransfer from the sediment to invertebrates is represented in this ERA using a sediment-to-invertebrate biotransfer factor (BTF). Sediment-to-invertebrate BTFs were developed in conjunction with EPA Region 4 and are presented in Table 3-13. The average and maximum sediment concentrations, multiplied by the appropriate approved BTF were used to estimate the concentration of bioaccumulative compounds in invertebrate tissue. The estimated ADD to aquatic insectivores (using the snowy egret as a surrogate), based on the average and maximum sediment concentrations, is presented in Table 3-14. Values for the various exposure model variables used to estimate ADD are also provided on Table 3-14.

The average and maximum ADD for aquatic insectivores (using the snowy egret as a surrogate) was compared to the wildlife TRVs (as presented previously) to derive a range of HQs for each bioaccumulative compound. The HQs developed for the bioaccumulative compounds detected in sediment at the site is presented in Table 3-15.

When the average ADD for a contaminant resulted in a LOAEL HQ greater than 1, the contaminant was considered to be a food chain exposure COPEC. None of the bioaccumulative contaminants produced an HQ greater than 1 based on the LOAEL.

When the maximum ADD for a contaminant resulted in a LOAEL HQ greater than 1, these contaminants were considered on a case-by-case basis. None of the bioaccumulative contaminants produced an HQ greater than 1 based on the LOAEL.

Based on this evaluation, the there were no contaminants in sediment that were considered to be COPEC for food chain exposure.

3.3 Distribution of COPEC

The analytical data for the COPEC identified in surface soils were evaluated to identify trends in the distribution of COPEC in each media. The evaluation was conducted to identify widespread COPEC, isolated hot spots, and the general relationships between COPEC in each media. Distribution of COPEC in sediment and surface water was not conducted since there were no COPEC in these two media.

3.3.1 Surface Soil COPEC Distribution

Nearly all of the surface soil samples contained at least two direct exposure COPEC (aluminum and iron) and these samples were generally coincident with known areas of ash deposition. Trends in the distribution and concentrations of COPEC detected in surface soil were based on a visual review of the soil analytical results presented in Table 2-4. In general, lead and zinc appear to be correlated with high concentrations of most COPEC (in addition to aluminum and iron). Samples with concentrations of concern for lead and zinc also contain the concentrations of concern for antimony, copper, mercury (although several isolated samples contained mercury, but not zinc, at levels of concern), and DDT. Based on this analysis, lead and zinc would appear to be effective indicator contaminants in surface soils at the site.

Concerning distribution of contaminants at levels of concern across the site, there appear to be several significant areas:

- The area of soil samples BDSB009, BDSB012, BDSB014, and BDSB016 contain several COPEC at levels of concern.

- The area of soil samples BDSB045, BDSB046, BDSB054, BDSB055, and BDSB058 contain several COPEC at levels of concern.

- The area of soil samples BDSB124, BDSB130, BDSB134, and BDSB136 contain several COPEC at levels of concern.

- The area of soil samples BDSB097 and BDSB101 contain several COPEC at levels of concern.

- The area of soil samples BDSB180 and BDSB182 all contain several COPEC at levels of concern.

- The area of soil samples BDSB039, BDSB040, BDSB041, BDSB042, and BDSB043 contained only mercury at levels of concern.

In addition to these areas, there are several isolated areas that also contained mercury, zinc, or copper (in addition to aluminum and iron) at levels of concern:

- BDSB149 (several COPEC)
- BDSB189 (several COPEC)
- BDSB307 (several COPEC)
- BDSB066 (only mercury)
- BDSB108 (only mercury)
- BDSB304 (only mercury)
- BDSB345 (only mercury)
- BDSB078 (only zinc)
- BDSB085 (only zinc)
- BDSB110 (only zinc)
- BDSB170 (only zinc)
- BDSB311 (only copper)

3.3.2 Sediment COPEC Distribution

There were no COPEC identified for sediment. As a result, an evaluation of COPEC distribution was not conducted.

3.3.3 Surface Water COPEC Distribution

There were no COPEC identified for surface water. As a result, an evaluation of COPEC distribution was not conducted.

3.4 Summary of Refinement

A summary of the direct exposure and food-chain exposure refinement of PCOPEC is provided for surface soil, sediment, and surface water.

3.4.1 Surface Soil

The soil refinement indicated that several contaminants appear to be widely distributed across the site, generally coincident with known areas of ash deposition. Based on the refinement, the following contaminants were identified as widespread direct exposure COPEC: aluminum, antimony, copper, iron, lead, zinc, mercury, and DDT. The food chain refinement indicates that lead, zinc, mercury, and DDT are present in surface soils at levels that may present a risk to terrestrial vermivores.

Samples with concentrations of concern for lead and zinc also contain the concentrations of concern for antimony, copper, and mercury (although several isolated samples contained mercury, but not lead or zinc, at levels of concern). Based on this analysis, lead and zinc would appear to be effective indicators of contamination in surface soils at the site. The RI Report has also indicated that the presence of visible ash is a good indicator of contamination (CH2M Hill 2000). There are six major areas of contamination as described in Section 3.3.1.

3.4.2 Sediment

The sediment refinement determined that there were no contaminants observed in sediment samples that were direct or food-chain exposure COPEC. Based on this information, sediment was eliminated as a media and exposure pathway of concern since the original (and probably most contaminated) sediments are suspected to have been excavated prior to the sediment sampling evaluated in this ERA.

3.4.3 Surface Water

The surface water refinement determined that there were no contaminants observed in surface water that were direct exposure COPEC. Surface water was not evaluated as a substrate media for food chain exposure because it represents a minor exposure pathway to wildlife. Based on this information, surface water was eliminated as a media and exposure pathway of concern.

3.5 Uncertainty

Screening toxicity values, refinement toxicity values, media biotransfer factors, wildlife TRVs, and ingestions dose exposure parameters for the food chain exposure models were all based on approved guidance from EPA Region 4 or were developed in conjunction with the EPA Region 4 Office of Technical Support. Any uncertainties associated with these variables considered in this ERA are consistent with those normal scientific uncertainties commonly accepted in ecological risk assessment. However, the development of, and selection of these variables has been intentionally designed to minimize the potential for the under-estimation of ecological risk at the site.

3.5.1 Uncertainties Related to Surface Soil Assessment

Uncertainties in the selection and identification of surface soil COPEC are related primarily to data quality, limitations of the reference soil data, and variables selected for the food chain exposure model.

3.5.1.1. Data Quality. The data for COPEC identified through the refinement process have been provided by an EPA approved analytical laboratory and have been validated in accordance with EPA standards. In most cases, data results that drive the assessment and refinement of risks in this ERA for the Brown's Dump Site do not include laboratory qualifiers (the data results stand as presented). However, most analytes identified as widespread COPEC also contain J-qualified data in the data set. J-qualified data indicate that the identification of the analyte is acceptable, but quality assurance criteria indicate that the quantitative values may be outside the normal range of precision, i.e., the quantitative value is considered estimated. J-qualified data is generally accepted for risk assessment purposes and it is unlikely that data quality adds significant uncertainty in the assessment of surface soils.

3.5.1.2. Lack of Use of Background Database. Due to questions raised about obtaining "true" background (or reference) samples in an area where the boundaries of the ash have not yet been delineated, the surface soil COPEC were not screened with respect to "normal" or reference concentrations. As a result, inorganic contaminants identified as COPEC may normally be present at the observed concentrations. However, to provide additional data to the risk managers for this site, the ERA includes a discussion of the background data in the earlier refinement discussion.

3.5.1.3. Food Chain Variables. The exposure equation used in the food chain exposure model relies on several variables that add uncertainty in the identification and assessment of bioaccumulative COPEC. For the purposes of screening and refinement, these variables are biased toward conservatism to over-estimate the exposure dose to avoid the elimination of risk-producing contaminants or exposure pathways. The FCM presented in the previous refinement makes the following conservative assumptions:

- When calculating the average concentrations of contaminants in soils, sediment, and surface water, non-detects were not incorporated. As a result, the average contaminant concentrations used in the food chain models are biased high and may be overly conservative.

- Bioavailability (BA) of COPEC in incidentally ingested soil or sediment has been assumed to be the same as bioavailability of COPED in prey items due to a lack of chemical-specific information. The exception was lead. For lead the exposure model assumes that the relative bioavailability of lead in soil is 60 percent after EPA (1999c). Actual BAs of all COPEC are likely to be less than 100 percent; therefore, potential risks from bioaccumulative COPEC are biased toward over-estimation.

- The area usage factor (AUF) for terrestrial receptor species is assumed to be 100 percent. This means that the receptor is assumed to spend all of its time in the contaminated area. Given the broad expanse of ash contamination and the potential for smaller animals to have smaller home ranges, this assumption is reasonable. For the aquatic insectivore, an actual area-use factor was calculated to be 0.097 based on the available foraging habitat at the site (2 acres) divided by the foraging area for a snowy egret (20.7 acres).

3.5.1.4. Variable Toxicity of Mercury. Mercury was unique in that there is significant variability in its bioavailability and toxicity as these properties relate to its chemical form. For example, mercuric chloride (used in the Human Health Risk Assessment) has a BAF of 0.04, whereas methyl mercury has a BAF of 8.5. This variability is significant and would indicate that mercury may or may not be a COPEC, depending on its chemical form. Eighty-two samples exceed the critical concentration for methyl mercury; however, only one sample exceeds the critical concentration for mercuric chloride. Since the speciation of mercury in surface soils at the site is unknown, the more conservative BAF was used to determine that mercury should be retained as a COPEC. The PRG developed for mercury is based on the bioavailability and toxicity of methyl mercury.

3.5.2 Uncertainties Related to Sediment Assessment

Uncertainties in the selection and identification of sediment COPEC are related primarily to data quality and variables selected for the food chain exposure model.

3.5.2.1. Data Quality. The data for COPEC identified through the refinement process have been provided by an EPA approved analytical laboratory and have been validated in accordance with EPA standards. In many cases, data results that drive the assessment and refinement of risks in this ERA for the Brown's Dump Site are "J"-qualified data or do not include laboratory qualifiers. J-qualified data indicate that the identification of the analyte is acceptable, but quality assurance criteria indicate that the quantitative values may be outside the normal range of precision, i.e., the quantitative value is considered estimated. J-qualified data is generally accepted for risk assessment purposes and it is unlikely that data quality adds significant uncertainty in assessment of surface soils.

3.5.2.2. Food Chain Variables. The exposure equation used in the food chain exposure model relies on several variables that add uncertainty in the identification and assessment of bioaccumulative COPEC. These uncertainties are the same as those discussed previously for the surface soils.

3.5.3 Uncertainties Related to Surface Water Assessment

Uncertainties in the selection and identification of surface water COPEC are related primarily to data quality.

3.5.3.1. Data Quality. The data for COPEC identified through the refinement process have been provided by an EPA-CLP analytical laboratory and have been validated in accordance with EPA standards. In all cases, data results that drive the assessment and refinement of risks in this ERA for the Brown's Dump Site are "J"-qualified data or do not include laboratory qualifiers. J-qualified data indicate that the identification of the analyte is acceptable, but quality assurance criteria indicate that the quantitative values may be outside the normal range of precision, i.e., the quantitative value is considered estimated. J-qualified data is generally accepted for risk assessment purposes and it is unlikely that data quality adds significant uncertainty in assessment of surface waters.

4.0 Conclusions

Based on the refinement of COPEC presented in this ERA, the following conclusions are presented on a media-by-media basis for surface soils, sediment, and surface waters evaluated at the Brown's Dump Site. These conclusions also consider the quality of the available habitat and the benefits/drawbacks to continuing with additional evaluations to more accurately define the ecological risks.

This ERA concludes that concentrations of COPEC in surface soil present a risk to terrestrial communities in the site vicinity. These risks are well defined and there are no additional ecological evaluations or assessments required to develop preliminary remedial goals for these contaminated media.

Sediment and surface water do not contain ecologically significant concentrations of contamination and are therefore not considered to be media of ecological concern at the site.

4.1 Surface Soils

The soil refinement indicated that several contaminants appear to be widely distributed across the site, generally coincident with known areas of ash deposition. Based on the refinement, the following contaminants were identified as widespread direct exposure COPEC: aluminum, antimony, copper, iron, lead, zinc, and mercury. Organisms in direct contact with surface soil such as soil invertebrates and plants are generally most significantly exposed to COPEC via direct exposure. In addition, vertebrates that live in close proximity to surface soil (e.g. burrowing animals and vermivores) may also be significantly exposed via direct exposure. The food chain refinement indicates that lead, zinc, and mercury are present in surface soils at levels that may present a risk to terrestrial vermivores through food chain exposure. Organisms that ingest other organisms, which have accumulated bioaccumulative COPEC, are more likely to be significantly exposed via the food chain exposure pathway. Generally, this includes herbivores, vermivores, and carnivores.

Nearly all of the surface soil samples contained at least two direct exposure COPEC (aluminum and iron) and these samples were generally coincident with known areas of ash deposition. In general, lead and zinc appear to be correlated with high concentrations of most inorganic COPEC (in addition to aluminum and iron). Samples with concentrations of concern for lead and zinc also contain the concentrations of concern for antimony, copper,

and mercury (although several isolated samples contained mercury, but not lead or zinc, at levels of concern). Based on this analysis, lead and zinc would appear to be an effective indicator contaminant in surface soils at the site.

Concerning distribution of contaminants at levels of concern across the site, there appear to be several significant areas:

- The area of soil samples BDSB009, BDSB012, BDSB014, and BDSB016 contain several COPEC at levels of concern.
- The area of soil samples BDSB045, BDSB046, BDSB054, BDSB055, and BDSB058 contain several COPEC at levels of concern.
- The area of soil samples BDSB124, BDSB130, BDSB134, and BDSB136 contain several COPEC at levels of concern.
- The area of soil samples BDSB097 and BDSB101 contain several COPEC at levels of concern.
- The area of soil samples BDSB180 and BDSB182 all contain several COPEC at levels of concern.
- The area of soil samples BDSB039, BDSB040, BDSB041, BDSB042, and BDSB043 contained only mercury at levels of concern.

In addition to these areas, there are several isolated areas that also contained mercury, zinc, or copper (in addition to aluminum and iron) at levels of concern:

- BDSB149 (several COPEC)
- BDSB189 (several COPEC)
- BDSB307 (several COPEC)
- BDSB066 (only mercury)
- BDSB108 (only mercury)
- BDSB304 (only mercury)
- BDSB345 (only mercury)
- BDSB078 (only zinc)

- BDSB085 (only zinc)
- BDSB110 (only zinc)
- BDSB170 (only zinc)
- BDSB311 (only copper)

Although not required, additional evaluations of soil toxicity may allow the development of a more accurate PRG by determining if the soils are actually exerting toxicity on plants and soil organisms. Given the large number of direct exposure COPEC, the variability of COPEC concentrations, and the variability of physical soil characteristics, it may be prohibitive to develop more accurate PRG than those that could be developed given the information currently available. In addition, the terrestrial habitats provided by the site are not particularly unique in the region and do not support species or ecological communities of special concern. Given all of these factors, no further ecological evaluations of surface soil are recommended at the Brown's Dump Site. PRGs for surface soil are presented in Section 5.0 of this Draft ERA.

4.2 Sediments

The sediment refinement determined that there were no contaminants observed in sediment that were direct or food-chain exposure COPEC. Based on this information, sediment was eliminated as a media and exposure pathway of concern. Additional ecological evaluations to more accurately define the risks from sediment are not recommended.

4.3 Surface Water

The surface water refinement determined that there were no contaminants observed in surface water that were direct exposure COPEC. Surface water was not evaluated as a substrate media for food chain exposure because it represents a minor exposure pathway to wildlife. Additional ecological evaluations to more accurately define the risks from surface water are not recommended.

5.0 Preliminary Remedial Goals (PRGs)

As started in the Section 4.0, Conclusions, PRGs will be developed for COPEC in surface soils evaluated at the Brown's Dump Site. PRGs will not be developed for contaminants in sediment or surface water since there were no COPEC in these two aquatic media.

5.1 Surface Soils

Based on the assumptions and limitations of this ERA for direct exposure and food chain exposure, PRGs were developed for surface soils evaluated at the site. The PRGs indicate concentrations that are assumed to be protective of soil organisms and plants in the habitats provided by the site through direct exposure. These PRGs are also protective of potential food chain exposure to predatory communities at the site. PRGs for direct exposure were based on the ecotoxicity values for refinement (or screening, if no refinement values were available) presented in Table 2-1. PRGs for food chain exposure were determined by back-calculating a concentration of COPEC that produced an HQ less than 1 for terrestrial vermivores. Where a PRGs for direct and food chain exposure COPEC could be calculated, the more conservative of the two values was the recommended PRG. Recommended PRGs for surface soil are presented on Table 5-1. PRGs are assumed to represent average attainment goals for COPEC.

6.0 References

Black & Veatch Special Projects Corp. 2000. Final Screening Level Risk Assessment for the Brown's Dump Superfund Site. March 2000.

Callahan, C.A., C.A. Menzie, D.E. Burmaster, D.C. Wilborn, T. Ernst. 1991. On-site methods for assessing chemical impact on the soil environment using earthworms: A case study at the Baird and McGuire Superfund Site, Holbrook, Massachusetts. Environ. Tox. Chem. 10(6):817-826.

Canadian Council of Ministers of the Environment (CCMOE). 1999. Canadian Sediment Quality Guidelines for the Protection of Aquatic Life – Summary Tables.

CCMOE, 1999b. Canadian Council of Ministers of the Environment, Canadian Environmental Quality Guidelines, Canadian Soil Quality Guidelines for the Protection of Environmental and Human Health – Summary Tables, 1999.

CCMOE, 1999c. Canadian Council of Ministers of the Environment, Canadian Environmental Quality Guidelines, Canadian Water Quality Guidelines for the Protection of Environmental and Human Health – Summary Tables, 1999.

CH2M Hill Team. 2000. Technical Memorandum: Preliminary Site Characterization for Brown's Dump Site. Prepared by CH2M Hill; England, Thims & Miller, Inc.; and Aerostar Environmental Services, Inc. August 2000.

Custer, T.W. and R.G. Osborn. 1978. Feeding habitat use by colonially-breeding herons, egrets, and ibises in North Carolina. The Auk 95:733-743.

DiToro, D.M. and J.A. McGrath. 2000. Technical basis for narcotic chemicals and polycyclic aromatic hydrocarbon criteria. *II. Mixtures and Sediments. Environ. Tox.* Chem. 19(8): 1971-1982.

Efroymson, R.A., M.E, Suter, G.W., and Wooten A.C. 1997a: Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Terrestrial Plants: 1997 Revision. Prepared by Lockheed Martin Energy Systems Inc.

Efroymson, R.A., Will, M.E, and Suter, G.W. 1997b. Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Soil and Litter Invertebrates and Heterotrophic Process: 1997 Revision. Prepared by Lockheed Martin Energy Systems Inc.

Eisler, R. 1986. Contaminant Hazard Review, published by USGS.

EPA 1988. Short-term methods for estimating the chronic toxicity of effluents and receiving waters to marine and estuarine organisms. EPA/600/4-87/028 (and 2nd edition). Cincinnati, OH. 417 pp.

EPA 1993a. Water Quality Guidance for the Great Lakes System and Correction: Proposed Rules. Federal Register. 58(72):20802-21047.

EPA. 1993b. U.S. Environmental Protection Agency, Office of Research and Development, Wildlife Exposure Factors Handbook, Vol. 1 of 2, EPA/600/R-93/187a, 1993.

EPA 1994. U.S. Environmental Protection Agency Environmental Office of Research and Development, Methods for Measuring Toxicity and Bioaccumulation of Sediment-associated Contaminants with Freshwater Invertebrates. EPA/600/R-94/024. June 1994.

EPA 1996. Eco Update (Ecotox Thresholds). Interim Bulletin Volume 3, Number 2. EPA 540/f-95/038, January 1996.

EPA 1997. U.S. Environmental Protection Agency Environmental Response Team, Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments - Interim Final. EPA 540-R-97-006. June 5, 1997.

EPA 1999. U.S. Environmental Protection Agency, Office of Water. National Ambient Water Quality Criteria - Correction. EPA822-Z-99-001. April 1999.

EPA 1999a. U.S. Environmental Protection Agency Region 4 Ecological Risk Assessment Bulletins – Supplemental to RAGS – Draft. August 11, 1999.

EPA 1999b. EPA Region 5 RCRA Ecological Data Quality Levels (EDQLs), Updated April 1999.

EPA 1999c. IEUBK Model Bioavailability Value. U.S. Environmental Protection Agency, Office of Emergency and Remedial Response, Washington D.C. EPA 540-F-00-006. OSWER 92385.7-32. October 1999.

EPA 2000a. Ecological Soil Screening Level Guidance – Draft. Office of Emergency and Remedial Response. Washington, D.C., July 2000.

EPA 2000b. "Bioaccumulation Testing and Interpretation for the Purpose of Sediment Quality Assessment", United States Environmental Protection Agency, Office of Water/Office of Solid Waste, EPA-823-R-00-001, February 2000.

Erwin, R.M. and J.A. Spendelow. 1991. Colonial wading birds: egrets and herons. Pages 19-1 through 19-4 in S.L. Funderburk, J.A. Mihursky, S.J. Jordan and E. Riley (eds.)

Habitat Requirements for Chesapeake Bay Living Resources. Second Edition. Chesapeake Research Consortium, Inc.

Ewell, W.S., Gorsuch, J.W., Ritter, M., Ruffing, C.J. 1993. Ecotoxicological effects of silver compounds. Proceedings, 1st Argentum International Conference on the Transport, Fate, and Effects of Silver in the Environment, Madison, WI, USA, August 8-10, p. 9.

FDEP, 2000. Florida Department of Environmental Protection, Florida Administrative Code, Chapter 62-302 Surface Water Quality Standards.

FDEP, 2000. Florida Department of Environmental Protection. Approach to the Assessment of Sediment Quality in Florida Coastal Water, Volume 1 – Development and Evaluation of Sediment Quality Assessment Guidelines, November 1994.

Jefferies, D.J. 1971. Some effects of p,p'-DDT and its metabolites on breeding passerine birds. Meded. Fakult Landbouwwertenschappen Gent. 36:34-42.

Kushlan, J. A. 1978. Feeding ecology of wading birds. Pages 249-297 in A. Sprunt, J. C. Ogden and S. Winckler (eds.) Wading Birds. National Audubon Society Research Report 7.

Long et al., 1995. Long, E.R., MacDonald, D.D., Smith, S.L., and Calder, F.D., "Incidence of Adverse Biological Effects within Ranges of Chemical Concentrations in Marine and Estuarine Sediments", submitted to Environmental Management, October 15, 1993.

Megharaj, M., D. Kantachote I. Singleton, R. Naidu. 2000. Effects of long-term contamination of DDT on soil microfauna with special reference to soil algae and algal transformation of DDT. Environmental Pollution 109:35-42.

NOAA 1999. National Oceanic and Atmospheric Administration. Sediment Quality Guidelines Developed for the National Status and Trends Program. June 12, 1991.

Persaud et al., 1990. Persaud, D., Jaagumagi, R., and Hayton, A., The Provincial Sediment Quality Guidelines, Ontario Ministry of the Environment, 1990.

Sample, B.E., Opresko, D.M., and Suter, G.W. Toxicological Benchmarks for Wildlife: 1996 Revision, U.S. Department of Energy.

Suter and Tsao, 1996. Suter II, G.W., and Tsao, C.L., Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Aquatic Biota: 1996 Revision, U.S. Department of Energy.

Terres, J. K. 1991. The Audubon Society Encyclopedia of North American Birds. Wings Book, New York. 1109 p.

van Gestel, Dirven-van Breeman, and Baerselman. 1993. Accumulation and elimination of cadmium, chromium, and zinc effects on growth and reproduction in Eisenia andrei (Oligochaeta, Annelida). The Science of the Total Environment, Supplement: 585-597.

van Gestel et al. 1992. Comparison of sublethal and lethal criteria for nine different chemicals in standardized toxicity tests using the earthworm Eisenia andrei. Ecotoxicology and Environmental Safety, 23(2): 206-220.

Tables

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Table 2-1
Approved Ecotoxicity Values for Screening and Refinement in the ERA: Surface Soils
Browns Dump Superfund Site

ParameterName	*Screening Values*				*Refinement Ecotoxicity Values*									
	EPA Region 4	EPA Region 5	Approved Screening Value for Use in ERA	Data Source	Plant Toxicity	Earthworm Toxicity	Soil Microbial Toxicity	Draft Eco-SSL Plant	Draft Eco-SSL Earthworm	Canadian Soil Quality	Other Sources	Range of Toxicity Values	Approved Refinement Value for Use in ERA	Data Source
Reference -->	a	b			c	d1	d2	e1	e2	f				
Dioxins (ng/KG)														
TEQ OF 2,3,7,8-TCDD	-	0.199	**0.199**	b	-	500000 (g)	-	-	-	-	-	500000 - 500000	**500000**	g
Inorganics (mg/KG)														
ALUMINUM	50	-	**50**	a	50	-	600	-	-	-	-	50 - 600	**600**	d2
ANTIMONY	3.5	0.1423	**3.5**	a	5	-		-	-	-	-	5 - 5	**5**	c
ARSENIC	10	5.7	**10**	a	10	60	100	37		12	-	10 - 100	**60**	d1
BARIUM	165	1.04	**165**	a	500	-	3000	-	-	500	-	500 - 3000	**500**	c, f
BERYLLIUM	1.1	1.06	**1.1**	a	10	-	-	-	-	-	-	10 - 10	**10**	c
CADMIUM	1.6	0.0022	**1.6**	a	4	20	20	29	110	10	-	4 - 110	**20**	d1, d2
CALCIUM	-	-	-	-	-	-	-	-	-	-	-	0 - 0		-
CHROMIUM, TOTAL	0.4	0.4	**0.4**	a	1	32 (j)	10	5	-	64	-	1 - 64	**32**	j
COBALT	20	0.14033	**20**	a	20	-	1000	-	-	-	-	20 - 1000	**1000**	d2
COPPER	40	0.3132	**40**	a	100	50	100	-	61	63	-	50 - 100	**61**	e2
IRON	200	-	**200**	a	-	-	200	-	-	-	-	200 - 200	**200**	a2
LEAD	50	0.05373	**50**	a	50	500	900	-	-	140	-	50 - 900	**500**	d1
MAGNESIUM	-	-	-	-	-	-	-	-	-	-	-	0 - 0		-
MANGANESE	100	-	**100**	a	500		100				-	100 - 500	**500**	c
NICKEL	30	13.6	**30**	a	30	200	90	-	-	50	-	30 - 200	**90**	d2
POTASSIUM	-	-	-	-				-	-	-	-	0 - 0		-
SELENIUM	0.81	0.02765	**0.81**	a	1	70	100	-	-	-	-	1 - 100	**70**	d1
SILVER	2	4.04	**2**	a	2	-	50	-	-	-	10	2 - 50	**10**	k
SODIUM	-	-	-	-		-	-	-	-	-	-	0 - 0		-
THALLIUM	1	0.05692	**1**	a	1	-	-	-	-	1	-	1 - 1	**1**	c
VANADIUM	2	1.59	**2**	a	2	-	20	-	-	130	-	2 - 130	**130**	f
ZINC	50	6.62	**50**	a	50	200	100	190	120	200	-	50 - 200	**200**	d1
MERCURY	0.1	0.1	**0.1**	a	0.3	0.1	-	-	-	6.6	-	0.1 - 6.6	**0.3**	c
CYANIDE	0.9	1.33	**0.9**	a	-	-	-	-	-	0.9	-	0.9 - 0.9	**5**	h
Pesticides (ug/KG)														
ALDRIN	2.5	3.32	**2.5**	a	-	-	-	-	-	-	-	0 - 0		-
ALPHA BHC (ALPHA HEXACHLOROCYCLOHEXANE)	2.5	99.39	**2.5**	a	-	-	-	-	-	-	-	0 - 0		-
ALPHA ENDOSULFAN (ENDOSULFAN I)	100	119.27	**100**	a	-	-	-	-	-	-	-	0 - 0		-
ALPHA-CHLORDANE	100	224	**100**	a	-	-	-	-	-	-	-	0 - 0		-
BETA BHC (BETA HEXACHLOROCYCLOHEXANE)	1	3.98	**1**	a	-	-	-	-	-	-	-	0 - 0		-
BETA ENDOSULFAN (ENDOSULFAN II)	100	119.27	**100**	a	-	-	-	-	-	-	-	0 - 0		-
DELTA BHC (DELTA HEXACHLOROCYCLOHEXANE)	1	9940	**1**	a	-	-	-	-	-	-	-	0 - 0		-
DIELDRIN	0.5	2.38	**0.5**	a	-	-	-	-	-	-	-	0 - 0		-
ENDOSULFAN SULFATE	100	35.78	**100**	a	-	-	-	-	-	-	-	0 - 0		-
ENDRIN	100	10.1	**100**	a	-	-	-	-	-	-	-	0 - 0		-
ENDRIN ALDEHYDE	100	10.5	**100**	a	-	-	-	-	-	-	-	0 - 0		-
ENDRIN KETONE	100	-	**100**	a	-	-	-	-	-	-	-	0 - 0		-
GAMMA BHC (LINDANE)	0.05	5	**0.05**	a	-	-	-	-	-	-	-	0 - 0		-
GAMMA-CHLORDANE	100	224	**100**	a	-	-	-	-	-	-	-	0 - 0		-
HEPTACHLOR	100	5.98	**100**	a	-	-	-	-	-	-	-	0 - 0		-
HEPTACHLOR EPOXIDE	100	151.88	**100**	a	-	-	-	-	-	-	-	0 - 0		-
METHOXYCHLOR	100	19.88	**100**	a	-	-	-	-	-	-	-	0 - 0		-
p,p'-DDD	2.5	758.15	**2.5**	a	-	-	-	-	-	-	-	0 - 0	**700**	f (DDT)
p,p'-DDE	2.5	595.87	**2.5**	a	-	-	-	-	-	-	-	0 - 0	**700**	f (DDT)
p,p'-DDT	2.5	17.5	**2.5**	a	-	-	-	-	-	700	-	700 - 700	**17.5**	b
TOXAPHENE	100	119.27	**100**	a	-	-	-	-	-	-	-	0 - 0		-
PCBs (ug/KG)														
PCB-1016 (AROCHLOR 1016)	20	0.332	**20**	a	40000	-	-	-	-	1300	-	1300 - 40000	**1300**	f
PCB-1221 (AROCHLOR 1221)	20	0.332	**20**	a	40000	-	-	-	-	1300	-	1300 - 40000	**1300**	f
PCB-1232 (AROCHLOR 1232)	20	0.332	**20**	a	40000	-	-	-	-	1300	-	1300 - 40000	**1300**	f
PCB-1242 (AROCHLOR 1242)	20	0.332	**20**	a	40000	-	-	-	-	1300	-	1300 - 40000	**1300**	f
PCB-1248 (AROCHLOR 1248)	20	0.332	**20**	a	40000	-	-	-	-	1300	-	1300 - 40000	**1300**	f
PCB-1254 (AROCHLOR 1254)	20	0.332	**20**	a	40000	-	-	-	-	1300	-	1300 - 40000	**1300**	f
PCB-1260 (AROCHLOR 1260)	20	0.332	**20**	a	40000	-	-	-	-	1300	-	1300 - 40000	**1300**	f
Volatile Organic Compounds (ug/KG)														
1,1,1-TRICHLOROETHANE	-	298000	**298000**	b	-	-	-	-	-	-	-	0 - 0		-
1,1,2,2-TETRACHLOROETHANE	-	127.22	**127.22**	b	-	-	-	-	-	-	-	0 - 0		-
1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE	-	-	-		-	-	-	-	-	-	-	0 - 0		-
1,1,2-TRICHLOROETHANE	-	28600	**28600**	b	-	-	-	-	-	-	-	0 - 0		-
1,1-DICHLOROETHANE	-	20100	**20100**	b	-	-	-	-	-	-	-	0 - 0		-
1,1-DICHLOROETHENE	-	8280	**8280**		-	-	-	-	-	-	-	0 - 0		-

3 12 0202

Table 2-1
Approved Ecotoxicity Values for Screening and Refinement in the ERA: Surface Soils
Browns Dump Superfund Site

ParameterName	Screening Values				Refinement Ecotoxicity Values									
	EPA Region 4	EPA Region 5	Approved Screening Value for Use in ERA	Data Source	Plant Toxicity	Earthworm Toxicity	Soil Microbial Toxicity	Draft Eco-SSL Plant	Draft Eco-SSL Earthworm	Canadian Soil Quality	Other Sources	Range of Toxicity Values	Approved Refinement Value for Use in ERA	Data Source
Reference -->	a	b			c	d1	d2	e1	e2	f				
1,2,4-TRICHLOROBENZENE	-	11100	11100	b	-	20000	-	-	-	-	-	20000 - 20000	20000	d1
1,2-DIBROMO-3-CHLOROPROPANE	-	35.18	35.18	b	-	-	-	-	-	-	-	0 - 0	-	-
1,2-DICHLOROBENZENE	10	37700	10	a	-	-	-	-	-	-	-	0 - 0	-	-
1,2-DICHLOROETHANE	400	21200	400	a	-	-	-	-	-	-	-	0 - 0	-	-
1,2-DICHLOROPROPANE	700000	32700	700000	a	-	700000	-	-	-	-	-	700000 - 700000	700000	d1
1,3-DICHLOROBENZENE	10	2960	10	a	-	-	-	-	-	-	-	0 - 0	-	-
1,4-DICHLOROBENZENE	10	545.59	10	a	-	20000	-	-	-	-	-	20000 - 20000	20000	d1
2-HEXANONE	-	12600	12600	b	-	-	-	-	-	-	-	0 - 0	-	-
4-BROMOFLUOROBENZENE	-	-	-		-	-	-	-	-	-	-	0 - 0	-	-
ACETONE	-	2500	2500	b	-	-	-	-	-	-	-	0 - 0	-	-
BENZENE	50	254.62	50	a	-	-	-	-	-	500	-	500 - 500	500	f
BROMODICHLOROMETHANE	-	539.78	539.78	b	-	-	-	-	-	-	-	0 - 0	-	-
BROMOFORM	-	15900	15900	b	-	-	-	-	-	-	-	0 - 0	-	-
BROMOMETHANE	-	-	-		-	-	-	-	-	-	-	0 - 0	-	-
CARBON DISULFIDE	-	94.12	94.12	b	-	-	-	-	-	-	-	0 - 0	-	-
CARBON TETRACHLORIDE	1000000	2980	1000000	a	-	-	1000	-	-	-	-	1000 - 1000	1000000	b2
CHLOROBENZENE	50	13100	50	a	-	40000	-	-	-	-	-	40000 - 40000	40000	d1
CHLOROETHANE	-	-	-		-	-	-	-	-	-	-	0 - 0	-	-
CHLOROFORM	1	1190	1	a	-	-	-	-	-	-	-	0 - 0	-	-
CHLOROMETHANE	-	10400	10400	b	-	-	-	-	-	-	-	0 - 0	-	-
cis-1,2-DICHLOROETHYLENE	-	783.73	783.73		-	-	-	-	-	-	-	0 - 0	-	-
cis-1,3-DICHLOROPROPENE	-	397.86	397.86	b	-	-	-	-	-	-	-	0 - 0	-	-
DIBROMOCHLOROMETHANE	-	2050	2050	b	-	-	-	-	-	-	-	0 - 0	-	-
DIBROMOFLUOROMETHANE	-	-	-		-	-	-	-	-	-	-	0 - 0	-	-
DICHLORODIFLUOROMETHANE	-	39500	39500	b	-	-	-	-	-	-	-	0 - 0	-	-
ETHYLBENZENE	50	5160	50	a	-	-	-	-	-	1200	-	1200 - 1200	1200	f
ETHYLENE DIBROMIDE (1,2-DIBROMOETHANE)	-	1230	1230	b	-	-	-	-	-	-	-	0 - 0	-	-
ISOPROPYLBENZENE (CUMENE)	-	-	-		-	-	-	-	-	-	-	0 - 0	-	-
M,P-XYLENE	50	10000	50	a	-	-	-	-	-	100	-	100 - 100	100	f
METHYL ETHYL KETONE (2-BUTANONE)	-	89600	89600	b	-	-	-	-	-	-	-	0 - 0	-	-
METHYL ISOBUTYL KETONE (4-METHYL-2-PENTANONE)	-	443000	443000	b	-	-	-	-	-	-	-	0 - 0	-	-
METHYL tert-BUTYL ETHER	-	-	-		-	-	-	-	-	-	-	0 - 0	-	-
METHYLENE CHLORIDE	-	4050	4050	b	-	-	-	-	-	-	-	0 - 0	-	-
O-XYLENE	50	10000	50	a	-	-	-	-	-	1000	-	1000 - 1000	1000	f
STYRENE	100	4690	100	a	300000	-	-	-	-	-	-	300000 - 300000	300000	c
TETRACHLOROETHYLENE(PCE)	10	9920	10	a	-	-	-	-	-	200	-	200 - 200	200	f
TOLUENE	50	5450	50	a	200000	-	-	-	-	800	-	800 - 200000	800	f
Semivolatile Organic Compounds (ug/KG														
1-METHYLNAPHTHALENE	-	3240	3240	b	-	-	-	-	-	-	-	0 - 0	-	-
2,4,5-TRICHLOROPHENOL	10	14.1	10	a	4000	9000	-	-	-	-	-	4000 - 9000	9000	d1
2,4,6-TRICHLOROPHENOL	10	9.94	10	a	-	10000	-	-	-	-	-	10000 - 10000	10000	d1
2,4-DICHLOROPHENOL	-	87.5	87.5	b	-	-	-	-	-	-	-	0 - 0	-	-
2,4-DIMETHYLPHENOL	-	10	10	b	-	-	-	-	-	-	-	0 - 0	-	-
2,4-DINITROPHENOL	20000	60.86	20000	a	20000	-	-	-	-	-	-	20000 - 20000	20000	c
2,4-DINITROTOLUENE	-	1280	1280	b	-	-	-	-	-	-	-	0 - 0	-	-
2,6-DINITROTOLUENE	-	32.83	32.83	b	-	-	-	-	-	-	-	0 - 0	-	-
2-CHLORONAPHTHALENE	-	12.18	12.18	b	-	-	-	-	-	-	-	0 - 0	-	-
2-CHLOROPHENOL	-	246.66	0	b	-	-	-	-	-	-	-	0 - 0	-	-
2-METHYLNAPHTHALENE	-	3240	3240	b	-	-	-	-	-	-	-	0 - 0	-	-
2-METHYLPHENOL (o-CRESOL)	500	40400	500	a	-	-	-	-	-	-	-	0 - 0	-	-
2-NITROANILINE	-	3160	3160	b	-	-	-	-	-	-	-	0 - 0	-	-
2-NITROPHENOL	-	1600	1600	b	-	-	-	-	-	-	-	0 - 0	-	-
3,3'-DICHLOROBENZIDINE	-	646.36	646.36	b	-	-	-	-	-	-	-	0 - 0	-	-
3-NITROANILINE	-	74100	74100	b	-	-	-	-	-	-	-	0 - 0	-	-
4,6-DINITRO-2-METHYLPHENOL	-	-	-	-	-	-	-	-	-	-	-	0 - 0	-	-
4-BROMOPHENYL PHENYL ETHER	-	-	-	-	-	-	-	-	-	-	-	0 - 0	-	-
4-CHLORO-3-METHYLPHENOL	-	-	-	-	-	-	-	-	-	-	-	0 - 0	-	-
4-CHLOROANILINE	-	1100	1100	b	-	-	-	-	-	-	-	0 - 0	-	-
4-CHLOROPHENYL PHENYL ETHER	-	-	-	-	-	-	-	-	-	-	-	0 - 0	-	-
4-NITROANILINE	-	21900	21900	b	-	-	-	-	-	-	-	0 - 0	-	-
4-NITROPHENOL	7000	5120	7000	a	-	7000	-	-	-	-	-	7000 - 7000	7000	d1
ACENAPHTHENE	20000	682500	20000	a	-	-	-	-	-	-	-	0 - 0	-	-
ACENAPHTHYLENE	-	682000	682000	b	-	-	-	-	-	-	-	0 - 0	-	-
ANTHRACENE	100	1480000	100	a	5000	-	-	-	-	-	-	5000 - 5000	5000	i

Table 2-1
Approved Ecotoxicity Values for Screening and Refinement in the ERA: Surface Soils
Browns Dump Superfund Site

ParameterName	*Screening Values*				*Refinement Ecotoxicity Values*									
	EPA Region 4	EPA Region 5	**Approved Screening Value for Use in ERA**	Data Source	Plant Toxicity	Earthworm Toxicity	Soil Microbial Toxicity	Draft Eco-SSL Plant	Draft Eco-SSL Earthworm	Canadian Soil Quality	Other Sources	Range of Toxicity Values	**Approved Refinement Value for Use in ERA**	Data Source
Reference --->	a	b			c	d1	d2	e1	e2	f				
BENZO(a)ANTHRACENE	-	5210	**5210**	b	5000	-	-	-	-	-	-	5000 - 5000	**5000**	i
BENZO(a)PYRENE	100	1520	**100**	a	5000	-	-	-	-	700	-	700 - 5000	**5000**	i
BENZO(b)FLUORANTHENE	-	59800	**59800**	b	5000	-	-	-	-	-	-	5000 - 5000	**5000**	i
BENZO(g,h,i)PERYLENE	-	119000	**119000**	b	5000	-	-	-	-	-	-	5000 - 5000	**5000**	i
BENZO(k)FLUORANTHENE	-	148000	**148000**	b	5000	-	-	-	-	-	-	5000 - 5000	**5000**	i
BENZYL BUTYL PHTHALATE	-	238.89	**238.89**	b	-	-	-	-	-	-	-	0 - 0	-	-
bis(2-CHLOROETHOXY) METHANE	-	302.09	**302.09**	-	-	-	-	-	-	-	-	0 - 0	-	-
bis(2-CHLOROETHYL) ETHER (2-CHLOROETHYL ETHER)	-	23700	**23700**	-	-	-	-	-	-	-	-	0 - 0	-	-
bis(2-CHLOROISOPROPYL) ETHER	-	-	-	-	-	-	-	-	-	-	-	0 - 0	-	-
bis(2-ETHYLHEXYL) PHTHALATE	-	925.94	**925.94**	-	-	-	-	-	-	-	-	0 - 0	-	-
CARBAZOLE	-	-	-	-	5000	-	-	-	-	-	-	5000 - 5000	**5000**	i
CHRYSENE	-	4730	**4730**	b	5000	-	-	-	-	-	-	5000 - 5000	**5000**	i
CRESOLS, M&P	500	3490	**500**	a	-	-	-	-	-	-	-	0 - 0	-	-
DIBENZ(a,h)ANTHRACENE	-	18400	**18400**	b	5000	-	-	-	-	-	-	5000 - 5000	**5000**	i
DIBENZOFURAN	-	-	-	-	-	-	-	-	-	-	-	0 - 0	-	-
DIETHYL PHTHALATE	100000	24800	**100000**	a	100000	-	-	-	-	-	-	100000 - 100000	**100000**	c
DIMETHYL PHTHALATE	200000	734000	**200000**	a	-	200000	-	-	-	-	-	200000 - 200000	**200000**	d1
DI-n-BUTYL PHTHALATE	200000	149.79	**200000**	a	200000	-	-	-	-	-	-	200000 - 200000	**2000001**	c
DI-n-OCTYLPHTHALATE	-	709000	**709000**	b	-	-	-	-	-	-	-	0 - 0	-	-
FLUORANTHENE	100	122000	**100**	a	5000	-	-	-	-	-	-	5000 - 5000	**5000**	i
FLUORENE	-	122000	**122000**	b	5000	-	-	-	-	-	-	5000 - 5000	**5000**	i
HEXACHLOROBENZENE	2.5	198.78	**2.5**	a	-	-	1000	-	-	-	-	1000 - 1000	**1000**	d2
HEXACHLOROBUTADIENE	-	39.76	**39.76**	b	-	-	-	-	-	-	-	0 - 0	-	-
HEXACHLOROCYCLOPENTADIENE	10000	755.37	**10000**	a	10000	-	-	-	-	-	-	10000 - 10000	**10000**	c
HEXACHLOROETHANE	-	596.34	**596.34**	b	-	-	-	-	-	-	-	0 - 0	-	-
INDENO(1,2,3-c,d)PYRENE	-	109000	**109000**	b	5000	-	-	-	-	-	-	5000 - 5000	**5000**	i
ISOPHORONE	-	139000	**139000**	b	-	-	-	-	-	-	-	0 - 0	-	-
NAPHTHALENE	100	99.39	**100**	a	5000	-	-	-	-	600	-	600 - 5000	**600**	f
NITROBENZENE	40000	1310	**40000**	a	-	40000	1000	-	-	-	-	1000 - 40000	**40000**	d1
N-NITROSODI-n-PROPYLAMINE	-	543.68	**543.68**	-	-	-	-	-	-	-	-	0 - 0	-	-
N-NITROSODIPHENYLAMINE	20000	545.14	**20000**	a	-	20000	-	-	-	-	-	20000 - 20000	**20000**	d1
PENTACHLOROPHENOL	2	119.27	**2**	a	3000	6000	400	-	-	7600	-	400 - 7600	**6000**	d1
PHENANTHRENE	100	45700	**100**	a	5000			-	-	-	-	5000 - 5000	**5000**	i
PHENOL	50	120000	**50**	a	70000	30000	1000	-	-	3800	-	1000 - 70000	**30000**	f
PYRENE	100	78500	**100**	a	5000	-	-	-	-	-	-	5000 - 5000	**5000**	i

References:

a) EPA 1999. U.S. Environmental Protection Agency Region 4 Ecological Risk Assessment Bulletins – Supplemental to RAGS – Draft. August 11, 1999.
b) EPA 1999. EPA Region 5 RCRA Ecological Data Quality Levels (EDQLs), Updated April 1999.
c) Efroymson, R.A., M.E. Suter, G.W., and Wooten A.C. 1997a. Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Terrestrial Plants: 1997 Revision. Prepared by Lockheed Martin Energy Systems Inc.
d1) Efroymson, R.A., Will, M.E. and Suter, G.W. 1997. Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Soil and Litter Invertebrates and Heterotrophic Process: 1997 Revision. Prepared by Lockheed Martin Energy Systems Inc. - Table 1
d2) Efroymson, R.A., Will, M.E. and Suter, G.W. 1997. Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Soil and Litter Invertebrates and Heterotrophic Process: 1997 Revision. Prepared by Lockheed Martin Energy Systems Inc. - Table 2
e1) EPA 2000. Ecological Soil Screening Level Guidance – Draft. Office of Emergency and Remedial Response. Washington, D.C., July 2000 (Plants).
e2) EPA 2000. Ecological Soil Screening Level Guidance – Draft. Office of Emergency and Remedial Response. Washington, D.C., July 2000 (Earthworms).
f) CCMOE, 1999. Canadian Council of Ministers of the Environment, Canadian Environmental Quality Guidelines, Canadian Soil Quality Guidelines for the Protection of Environmental and Human Health – Summary Tables, 1999.
g) Reinecke, A.J. and R.G. Nash. 1984. Toxicity of 2,3,7,8-TCDD to earthworms (Oligochaeta). Soil Biology and Biochemistry 16(1).45-49.
h) Value for cyanide complexes.
i) Erstfeld, K.M. and J. Snow-Ashbrook. 1999. Effects of chronic low-level PAH contamination on soil invertebrate communities. Chemosphere 39(12):2117-2139.
j) van Gestel, Dirven-van Breeman, and Baerselman. 1993. Accumulation and elimination of cadmium, chromium, and zinc effects on growth and reproduction in Eisenia andrei (Oligochaeta, Annelida). The Science of the Total Environment, Supplement: 585-597
k) Eisler, R. 1996. Contaminant Hazard Review, published by USGS.

Table 2-2
Approved Ecotoxicity Values for Screening and Refinement in the ERA: Sediments
Browns Dump Superfund Site

ParameterName	*Screening Values*				*Refinement Ecotoxicity Values*													
	EPA Region 4	EPA Region 5	**Approved Screening Value for Use in ERA**	Data Source	NOAA ER-L	NOAA ER-M	Florida SQAG TEL	Florida SQAG PEL	EPA Ecotox Fresh	EPA Ecotox Marine	Canadian Sediment ISQG	Canadian Sediment PEL	OMOE Low	OMOE Severe	Other Sources	Range of Toxicity Values	**Approved Refinement Value for Use in ERA**	Data Source
Reference -->	a	b			c1	c2	d1	d2	e1	e2	f1	f2	g1	g2				
Dioxins (ng/KG)																		
TEQ OF 2,3,7,8-TCDD	2.5	3.3	**2.5**	a	-	-	-	-	-	-	-	-	-	-	25 l	25 - 25	**25**	l
Inorganics (mg/KG)																		
ALUMINUM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0 - 0	-	
ANTIMONY	2	-	**2**	a	2	25	-	-	-	-	-	-	-	-	-	2 - 25	**25**	c2
ARSENIC	7.24	5.9	**7.24**	a	8.2	70	7.24	41.6	-	-	5.9	17	6	33	-	5.9 - 70	**17**	2
BARIUM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	200 h	200 - 200	**200**	h
BERYLLIUM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0 - 0	-	
CADMIUM	0.676	0.596	**0.676**	a	1.2	9.6	0.676	4.21	-	-	0.6	3.5	0.6	10	-	0.6 - 10	**3.5**	f2
CALCIUM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0 - 0	-	
CHROMIUM, TOTAL	52.3	26	**52.3**	a	81	370	52.3	160	-	-	37.3	90	26	110	-	26 - 370	**90**	f2
COBALT	-	50	**50**	b	-	-	-	-	-	-	-	-	-	-	20 h	20 - 20	**20**	h
COPPER	18.7	16	**18.7**	a	34	270	18.7	108	-	-	35.7	197	16	110	-	16 - 270	**108**	d2
IRON	-	-	-	-	-	-	-	-	-	-	-	-	20000	40000	-	20000 - 40000	**20000**	g1
LEAD	30.2	31	**30.2**	a	46.7	218	30.2	112	-	-	35	91.3	31	250	-	30.2 - 250	**91.3**	f2
MAGNESIUM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0 - 0	-	
MANGANESE	-	-	-	-	-	-	-	-	-	-	-	-	460	1100	-	460 - 1100	**460**	g1
NICKEL	15.9	16	**15.9**	a	20.9	51.6	15.9	42.8	-	-	-	-	16	75	-	15.9 - 75	**42.8**	d2
POTASSIUM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0 - 0	-	
SELENIUM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0 - 0	-	
SILVER	0.733	0.5	**0.733**	a	1	3.7	0.733	1.77	-	-	-	-	-	-	-	0.733 - 3.7	**1.77**	d2
SODIUM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0 - 0	-	
THALLIUM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0 - 0	-	
VANADIUM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0 - 0	-	
ZINC	124	120	**124**	a	150	410	124	271	-	-	123	315	120	820	-	120 - 820	**270**	d2
MERCURY	0.13	-	**0.13**	a	0.15	0.71	0.13	0.696	-	-	0.17	0.486	0.2	2	-	0.13 - 2	**0.486**	f2
CYANIDE	-	0.0001	**0.0001**	b	-	-	-	-	-	-	-	-	-	-	1 h	1 - 1	**1**	h
Pesticides (ug/KG)					-	-	-	-	-	-	-	-	-	-	-			
ALDRIN	-	2	**2**	b	-	-	-	-	-	-	-	-	2	80	-	2 - 80	**2**	g1
ALPHA BHC (ALPHA HEXACHLOROCYCLOHEXANE)	-	6	**6**	b	-	-	-	-	-	-	-	-	6	100	-	6 - 100	**6**	g1
ALPHA ENDOSULFAN (ENDOSULFAN I)	-	0.175	**0.175**	b	-	-	-	-	-	-	-	-	-	-	-	0 - 0	-	
ALPHA-CHLORDANE	0.5	4.5	**0.5**	a	0.5	6	2.26	4.79	-	-	-	-	7	60	-	0.5 - 60	**4.79**	d2
BETA BHC (BETA HEXACHLOROCYCLOHEXANE)	-	5	**5**	b	-	-	-	-	-	-	-	-	5	210	-	5 - 210	**5**	g1
BETA ENDOSULFAN (ENDOSULFAN II)	-	0.104	**0.104**	b	-	-	-	-	-	-	-	-	-	-	-	0 - 0	-	
DELTA BHC (DELTA HEXACHLOROCYCLOHEXANE)	-	71500	**71500**	b	-	-	-	-	-	-	-	-	3	210	-	3 - 210	**3**	g1
DIELDRIN	0.02	2	**0.02**	a	0.02	8	0.715	4.3	52	95	2.85	6.67	2	910	-	0.02 - 910	**4.3**	d2
ENDOSULFAN SULFATE	-	34.6	**34.6**	b	-	-	-	-	-	-	-	-	-	-	-	0 - 0	-	
ENDRIN	0.02	2.67	**0.02**	a	0.02	45			20	3.5	2.67	62.4	3	1300	-	0.02 - 1300	**62.4**	f2
ENDRIN ALDEHYDE	-	3200	**3200**	b	-	-	-	-	-	-	-	-	-	-	-	0 - 0	-	
ENDRIN KETONE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0 - 0	-	
GAMMA BHC (LINDANE)	0.32	0.94	**0.32**	a			0.32	0.99	3.7	-	0.94	1.38	3	10	-	0.32 - 10	**0.99**	d2
GAMMA-CHLORDANE	0.5	4.5	**0.5**	a	0.5	6	2.26	4.79	-	-	-	-	7	60	-	0.5 - 60	**4.79**	d2
HEPTACHLOR	-	0.6	**0.6**	b	-	-	-	-	-	-	-	-	-	-	-	0 - 0	-	
HEPTACHLOR EPOXIDE	-	0.6	**0.6**	b	-	-	-	-	-	-	0.6	2.74	5	50	-	0.6 - 50	**2.74**	f2
METHOXYCHLOR	-	3.59	**3.59**	b	-	-	-	-	19	-			-	-	-	19 - 19	**19**	e1
p,p'-DDD	1.22	5.53	**1.22**	a	2	20	1.22	7.81	-	-	3.54	8.51	8	60	-	1.22 - 60	**7.81**	d2
p,p'-DDE	2.07	1.42	**2.07**	a	2.2	27	2.07	374	-	-	1.42	6.75	5	190	-	1.42 - 374	**6.75**	f2
p,p'-DDT	1.19	1.19	**1.19**	a	1	7	1.19	4.77	-	-	1.19	4.77	8	710	-	1 - 710	**4.77**	d2, f2
TOXAPHENE	-	0.109	**0.109**	b	-	-	-	-	28	-	0.1	-	-	-	-	0.1 - 28	**28**	e1
PCBs (ug/KG)																		
PCB-1016 (AROCHLOR 1016)	-	34.1	**34.1**	b	22.7	180	21.6	189	-	-	34.1	277	7	530	-	7 - 530	**189**	d2
PCB-1221 (AROCHLOR 1221)	-	34.1	**34.1**	b	22.7	180	21.6	189	-	-	34.1	277	-	-	-	21.6 - 277	**189**	d2
PCB-1232 (AROCHLOR 1232)	-	34.1	**34.1**	b	22.7	180	21.6	189	-	-	34.1	277	-	-	-	21.6 - 277	**189**	d2
PCB-1242 (AROCHLOR 1242)	-	34.1	**34.1**	b	22.7	180	21.6	189	-	-	34.1	277	-	-	-	21.6 - 277	**189**	d2
PCB-1248 (AROCHLOR 1248)	-	34.1	**34.1**	b	22.7	180	21.6	189	-	-	34.1	277	30	1500	-	21.6 - 1500	**189**	d2
PCB-1254 (AROCHLOR 1254)	-	34.1	**34.1**	b	22.7	180	21.6	189	-	-	60	340	60	340	-	21.6 - 340	**189**	d2
PCB-1260 (AROCHLOR 1260)	-	34.1	**34.1**	b	22.7	180	21.6	189	-	-	34.1	277	5	240	-	5 - 277	**189**	d2
Volatile Organic Compounds (ug/KG)																		
1,1,1-TRICHLOROETHANE	-	246.85	**246.85**	b	-	-	-	-	170	-	-	-	-	-	-	170 - 170	**170**	e1
1,1,2,2-TETRACHLOROETHANE	-	29.08	**29.08**	b	-	-	-	-	940	-	-	-	-	-	-	940 - 940	**940**	e1
1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0 - 0	-	
1,1,2-TRICHLOROETHANE	-	673.51	**673.51**	b	-	-	-	-	-	-	-	-	-	-	-	0 - 0	-	
1,1-DICHLOROETHANE	-	0.575	**0.575**	b	-	-	-	-	-	-	-	-	-	-	-	0 - 0	-	

3.12 0205

Table
Approved Ecotoxicity Values for Screening and Refinement in the ERA: Sediments
Browns Dump Superfund Site

ParameterName	*Screening Values*				*Refinement Ecotoxicity Values*													
	EPA Region 4	EPA Region 5	**Approved Screening Value for Use in ERA**	Data Source	NOAA ER-L	NOAA ER-M	Florida SQAG TEL	Florida SQAG PEL	EPA Ecotox Fresh	EPA Ecotox Marine	Canadian Sediment ISQG	Canadian Sediment PEL	OMOE Low	OMOE Severe	Other Sources	Range of Toxicity Values	**Approved Refinement Value for Use in ERA**	Data Source
Reference --->	a	b			c1	c2	d1	d2	e1	e2	f1	f2	g1	g2				
1,1-DICHLOROETHENE	-	23.27	**23.27**	b	-	-	-	-	-	-	-	-	-	-	-	0 - 0		
1,2,4-TRICHLOROBENZENE	-	11700	**11700**	b	-	-	-	-	9200	-	-	-	-	-	-	9200 - 9200	**9200**	e1
1,2-DIBROMO-3-CHLOROPROPANE	-	19.98	**19.98**	b	-	-	-	-	-	-	-	-	-	-	-	0 - 0		
1,2-DICHLOROBENZENE	-	3010	**3010**	b	-	-	-	-	340	-	-	-	-	-	-	340 - 340	**340**	e1
1,2-DICHLOROETHANE	-	54.18	**54.18**	b	-	-	-	-	-	-	-	-	-	-	-	0 - 0		
1,2-DICHLOROPROPANE	-	351.61	**351.61**	b	-	-	-	-	-	-	-	-	-	-	-	0 - 0		
1,3-DICHLOROBENZENE	-	231.32	**231.32**	b	-	-	-	-	1700	-	-	-	-	-	-	1700 - 1700	**1700**	e1
1,4-DICHLOROBENZENE	-	1450	**1450**	b	-	-	-	-	350	-	-	-	-	-	-	350 - 350	**350**	e1
2-HEXANONE	-	1010	**1010**	b	-	-	-	-	-	-	-	-	-	-	-	0 - 0		
4-BROMOFLUOROBENZENE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0 - 0		
ACETONE	-	453.37	**453.37**	b	-	-	-	-	-	-	-	-	-	-	-	0 - 0		
BENZENE	-	141.57	**141.57**	b	-	-	-	-	57	-	-	-	-	-	-	57 - 57	**57**	e1
BROMODICHLOROMETHANE	-	1.13	**1.13**	b	-	-	-	-	-	-	-	-	-	-	-	0 - 0		
BROMOFORM	-	996.27	**996.27**	b	-	-	-	-	-	-	-	-	-	-	-	0 - 0		
BROMOMETHANE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0 - 0		
CARBON DISULFIDE	-	133.97	**133.97**	b	-	-	-	-	-	-	-	-	-	-	-	0 - 0		
CARBON TETRACHLORIDE	-	35.73	**35.73**	b	-	-	-	-	-	-	-	-	-	-	-	0 - 0		
CHLOROBENZENE	-	61.94	**61.94**	b	-	-	-	-	820	-	-	-	-	-	-	820 - 820	**820**	e1
CHLOROETHANE	-	58600	**58600**	b	-	-	-	-	-	-	-	-	-	-	-	0 - 0		
CHLOROFORM	-	27	**27**	b	-	-	-	-	-	-	-	-	-	-	-	0 - 0		
CHLOROMETHANE	-	0.0785	**0.0785**	b	-	-	-	-	-	-	-	-	-	-	-	0 - 0		
cis-1,2-DICHLOROETHYLENE	-	208.94	**208.94**	-	-	-	-	-	-	-	-	-	-	-	-	0 - 0		
cis-1,3-DICHLOROPROPENE	-	2.96	**2.96**	-	-	-	-	-	-	-	-	-	-	-	-	0 - 0		
DIBROMOCHLOROMETHANE	-	267.61	**267.61**	b	-	-	-	-	-	-	-	-	-	-	-	0 - 0		
DIBROMOFLUOROMETHANE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0 - 0		
DICHLORODIFLUOROMETHANE	-	1.33	**1.33**	b	-	-	-	-	-	-	-	-	-	-	-	0 - 0		
ETHYLBENZENE	-	0.1	**0.1**	b	-	-	-	-	3600	-	-	-	-	-	-	3600 - 3600	**3600**	e1
ETHYLENE DIBROMIDE (1,2-DIBROMOETHANE)	-	12.37	**12.37**	b	-	-	-	-	-	-	-	-	-	-	-	0 - 0		
ISOPROPYLBENZENE (CUMENE)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0 - 0		
M,P-XYLENE	-	1880	**1880**	b	-	-	-	-	25	-	-	-	-	-	-	25 - 25	**25**	e1
METHYL ETHYL KETONE (2-BUTANONE)	-	136.96	**136.96**	b	-	-	-	-	-	-	-	-	-	-	-	0 - 0		
METHYL ISOBUTYL KETONE (4-METHYL-2-PENTANONE)	-	544.37	**544.37**	b	-	-	-	-	-	-	-	-	-	-	-	0 - 0		
METHYL tert-BUTYL ETHER	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0 - 0		
METHYLENE CHLORIDE	-	1260	**1260**	b	-	-	-	-	-	-	-	-	-	-	-	0 - 0		
O-XYLENE	-	1880	**1880**	b	-	-	-	-	-	-	-	-	-	-	50 h	0 - 0	**50**	h
STYRENE	-	444.96	**444.96**	b	-	-	-	-	-	-	-	-	-	-	100 h	0 - 0	**100**	h
TETRACHLOROETHYLENE(PCE)	-	195.83	**195.83**	b	-	-	-	-	530	-	-	-	-	-	-	530 - 530	**530**	e1
TOLUENE	-	52500	**52500**	b	-	-	-	-	670	-	-	-	-	-	-	670 - 670	**670**	e1
Semivolatile Organic Compounds (ug/KG																		
1-METHYLNAPHTHALENE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0 - 0		
2,4,5-TRICHLOROPHENOL	-	85.56	**85.56**	b	-	-	-	-	-	-	-	-	-	-	1 h	0 - 0	**1**	h
2,4,6-TRICHLOROPHENOL	-	84.84	**84.84**	b	-	-	-	-	-	-	-	-	-	-	1 h	0 - 0	**1**	h
2,4-DICHLOROPHENOL	-	133.63	**133.63**	b	-	-	-	-	-	-	-	-	-	-	-	0 - 0		
2,4-DIMETHYLPHENOL	-	304.53	**304.53**	b	-	-	-	-	-	-	-	-	-	-	-	0 - 0		
2,4-DINITROPHENOL	-	1.33	**1.33**	b	-	-	-	-	-	-	-	-	-	-	-	0 - 0		
2,4-DINITROTOLUENE	-	75.13	**75.13**	b	-	-	-	-	-	-	-	-	-	-	-	0 - 0		
2,6-DINITROTOLUENE	-	20.62	**20.62**	b	-	-	-	-	-	-	-	-	-	-	-	0 - 0		
2-CHLORONAPHTHALENE	-	417.23	**417.23**	b	-	-	-	-	-	-	-	-	-	-	-	0 - 0		
2-CHLOROPHENOL	-	11.7	**11.7**	b	-	-	-	-	-	-	-	-	-	-	-	0 - 0		
2-METHYLNAPHTHALENE	20.23	20.2	**20.23**	a	70	670	20.2	201	-	-	20.2	201	-	-	-	20.2 - 670	**201**	d2, f2
2-METHYLPHENOL (o-CRESOL)	-	0.826	**0.826**	b	-	-	-	-	-	-	-	-	-	-	-	0 - 0		
2-NITROANILINE	-	0.222	**0.222**	b	-	-	-	-	-	-	-	-	-	-	-	0 - 0		
2-NITROPHENOL	-	7.77	**7.77**	b	-	-	-	-	-	-	-	-	-	-	-	0 - 0		
3,3'-DICHLOROBENZIDINE	-	28.22	**28.22**	b	-	-	-	-	-	-	-	-	-	-	-	0 - 0		
3-NITROANILINE	-	0.222	**0.222**	b	-	-	-	-	-	-	-	-	-	-	-	0 - 0		
4,6-DINITRO-2-METHYLPHENOL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0 - 0		
4-BROMOPHENYL PHENYL ETHER	-	1550	**1550**	b					1300							1300 - 1300	**1300**	e1
4-CHLORO-3-METHYLPHENOL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0 - 0		
4-CHLOROANILINE	-	146.08	**146.08**	b	-	-	-	-	-	-	-	-	-	-	-	0 - 0		
4-CHLOROPHENYL PHENYL ETHER	-	656.12	**656.12**	b	-	-	-	-	-	-	-	-	-	-	-	0 - 0		
4-NITROANILINE	-	0.222	**0.222**	b	-	-	-	-	-	-	-	-	-	-	-	0 - 0		
4-NITROPHENOL	-	7.78	**7.78**	b	-	-	-	-	-	-	-	-	-	-	-	0 - 0		
ACENAPHTHENE	6.71	6.71	**6.71**	a	16	500	6.71	88.9	620	1100	6.71	88.9	-	-	-	6.71 - 1100	**88.9**	d2, f2

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Reference -->	a	b			c1	c2	d1	d2	e1	e2	f1	f2	g1	g2				
ACENAPHTHYLENE	5.87	5.87	**5.87**	a	44	640	5.87	128	-	-	5.87	128	-	-	-	5.87 - 640	**128**	d2, f2
ANTHRACENE	46.9	46.9	**46.9**	a	85.3	1100	46.9	245	-	-	46.9	245	-	-	-	46.9 - 1100	**245**	d2, f2
BENZO(a)ANTHRACENE	74.8	31.7	**74.8**	a	261	1600	74.8	693	-	-	31.7	385	-	-	-	31.7 - 1600	**385**	f2
BENZO(a)PYRENE	88.8	31.9	**88.8**	a	430	1600	88.8	763	-	-	31.9	782	-	-	-	31.9 - 1600	**763**	d2
BENZO(b)FLUORANTHENE	-	10400	**10400**	b	-	-	-	-	-	-	-	-	-	-	-	0 - 0	-	
BENZO(g,h,i)PERYLENE	-	170	**170**	b	-	-	-	-	-	-	-	-	-	-	-	0 - 0	-	
BENZO(k)FLUORANTHENE	-	240	**240**	b	-	-	-	-	-	-	-	-	-	-	-	0 - 0	-	
BENZYL BUTYL PHTHALATE	-	4190	**4190**	b	-	-	-	-	11000	-	-	-	-	-	-	11000 - 11000	**11000**	e1
bis(2-CHLOROETHOXY) METHANE	-	349.71	**349.71**	b	-	-	-	-	-	-	-	-	-	-	-	0 - 0	-	
bis(2-CHLOROETHYL) ETHER (2-CHLOROETHYL ETHER)	-	211.96	**211.96**	b	-	-	-	-	-	-	-	-	-	-	-	0 - 0	-	
bis(2-CHLOROISOPROPYL) ETHER	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0 - 0	-	
bis(2-ETHYLHEXYL) PHTHALATE	182	182	**182**	a	-	-	182	2647	-	-	-	-	-	-	-	182 - 2647	**2647**	d2
CARBAZOLE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0 - 0	-	
CHRYSENE	108	57.1	**108**	a	384	2800	108	846			57.1	862	-	-	-	57.1 - 2800	**846**	d2
CRESOLS, M&P	-	0.808	**0.808**	b	-	-	-	-	-	-	-	-	-	-	-	0 - 0	-	
DIBENZ(a,h)ANTHRACENE	6.22	6.22	**6.22**	a	63.4	260	6.22	135			6.22	135	-	-	-	6.22 - 260	**135**	d2, f2
DIBENZOFURAN	-	1520	**1520**	b	-	-	-	-	2000	-	-	-	-	-	-	2000 - 2000	**2000**	e1
DIETHYL PHTHALATE	-	8.04	**8.04**	b	-	-	-	-	-	-	-	-	-	-	-	0 - 0	-	
DIMETHYL PHTHALATE	-	24.95	**24.95**	b	-	-	-	-	-	-	-	-	-	-	-	0 - 0	-	
DI-n-BUTYL PHTHALATE	-	110.5	**110.5**	b	-	-	-	-	-	-	-	-	-	-	-	0 - 0	-	
DI-n-OCTYLPHTHALATE	-	40600	**40600**	b	-	-	-	-	-	-	-	-	-	-	-	0 - 0	-	
FLUORANTHENE	113	111.3	**113**	a	600	5100	113	1494	2900	1400	111	2355	-	-	-	111 - 5100	**1494**	d2
FLUORENE	21.2	21.2	**21.2**	a	19	540	21.2	144	540		21.2	144	-	-	-	19 - 540	**144**	d2, f2
HEXACHLOROBENZENE	-	20	**20**	b	-	-	-	-	-	-	-	-	-	-	25 h	0 - 0	**25**	h
HEXACHLOROBUTADIENE	-	1380	**1380**	b	-	-	-	-	-	-	-	-	-	-	-	0 - 0	-	
HEXACHLOROCYCLOPENTADIENE	-	900.74	**900.74**	b	-	-	-	-	-	-	-	-	-	-	-	0 - 0	-	
HEXACHLOROETHANE	-	2230	**2230**	b	-	-	-	-	1000	-	-	-	-	-	-	1000 - 1000	**1000**	e1
INDENO(1,2,3-c,d)PYRENE	-	200	**200**	b	-	-	-	-	-	-	-	-	-	-	-	0 - 0	-	
ISOPHORONE	-	422.3	**422.3**	b	-	-	-	-	-	-	-	-	-	-	-	0 - 0	-	
NAPHTHALENE	34.6	34.6	**34.6**	a	160	2100	34.6	391	480	-	34.6	391	-	-	-	34.6 - 2100	**391**	d2, f2
NITROBENZENE	-	487.6	**487.6**	b	-	-	-	-	-	-	-	-	-	-	-	0 - 0	-	
N-NITROSODI-n-PROPYLAMINE	-	0.217	**0.217**	-	-	-	-	-	-	-	-	-	-	-	-	0 - 0	-	
N-NITROSODIPHENYLAMINE	-	155.24	**155.24**	b	-	-	-	-	-	-	-	-	-	-	-	0 - 0	-	
PENTACHLOROPHENOL	-	30100	**30100**	b	-	-	-	-	-	-	-	-	-	-	-	0 - 0	-	
PHENANTHRENE	86.7	41.9	**86.7**	a	240	1500	86.7	544	850	1100	41.9	515	-	-	-	41.9 - 1500	**515**	f2
PHENOL	-	27.26	**27.26**	b	-	-	-	-	-	-	-	-	-	-	50 h	0 - 0	**50**	h
PYRENE	153	53	**153**	a	665	2600	153	1398	-	-	53	875	-	-	-	53 - 2600	**875**	f2

References:

a) EPA 1999. U.S. Environmental Protection Agency Region 4 Ecological Risk Assessment Bulletins – Supplemental to RAGS – Draft. August 11, 1999.
b) EPA 1999. EPA Region 5 RCRA Ecological Data Quality Levels (EDQLs). Updated April 1999.
c1) Long et al., 1995. Long. E.R., MacDonald. D.D., Smith, S.L., and Calder, F.D., "Incidence of Adverse Biological Effects within Ranges of Chemical Concentrations in Marine and Estuarine Sediments", submitted to Environmental Management, October 15, 1993. - ER-L Values
c2) Long et al., 1995. Long, E.R., MacDonald, D.D., Smith, S.L., and Calder, F.D., "Incidence of Adverse Biological Effects within Ranges of Chemical Concentrations in Marine and Estuarine Sediments", submitted to Environmental Management, October 15, 1993. - ER-M Values
d1) FDEP, 2000. Florida Department of Environmental Protection. Approach to the Assessment of Sediment Quality in Florida Coastal Water, Volume 1 – Development and Evaluation of Sediment Quality Assessment Guidelines, November 1994. - TEL Values
d2) FDEP, 2000. Florida Department of Environmental Protection. Approach to the Assessment of Sediment Quality in Florida Coastal Water, Volume 1 – Development and Evaluation of Sediment Quality Assessment Guidelines, November 1994. - PEL Values
e1) USEPA 1996. Eco Update (Ecotox Thresholds). Interim Bulletin Volume 3, Number 2. EPA 540/f-95/038, January 1996 - Freshwater Sediment Values
e2) USEPA 1996. Eco Update (Ecotox Thresholds). Interim Bulletin Volume 3, Number 2. EPA 540/f-95/038, January 1996 - MarineSediment Values
f1) CCMOE, 1999. Canadian Council of Ministers of the Environment, Canadian Environmental Quality Guidelines, Canadian Sediment Quality Guidelines for the Protection of Environmental and Human Health – Summary Tables, 1999 - ISQG Values
f2) CCMOE, 1999. Canadian Council of Ministers of the Environment, Canadian Environmental Quality Guidelines, Canadian Sediment Quality Guidelines for the Protection of Environmental and Human Health – Summary Tables, 1999 - PEL Values
g1) Persaud et al., 1990. Persaud, D., Jaagumagi, R., and Hayton, A., The Provincial Sediment Quality Guidelines, Ontario Ministry of the Environment, 1990 -Low Effect Values
g2) Persaud et al., 1990. Persaud, D., Jaagumagi, R., and Hayton, A., The Provincial Sediment Quality Guidelines, Ontario Ministry of the Environment, 1990 - Severe Effect Values
h) MHSPE, 2000. Ministry of Housing, Spatial Planning and Environment, Directorate General for Environmental Protection, Department of Soil Protection. Dutch Soil/Sediment Cleanup Standards, The Netherlands, 2000.
i) Barber, Timothy R., Daniel J. Chappie, Deborah J. Duda, Phyllis C. Fuchsman, Brent L. Finley, 1998: Using A Spiked Sediment Bioassay To Establish A No-Effect Concentration For Dioxin Exposure To The Amphipod Ampelisca abdita. Environmental Toxicology and Chemistry: Vol. 17, No. 3, pp. 420–424.

Table 2-3
Approved Ecotoxicity Values for Screening and Refinement in the ERA: Freshwater
Browns Dump Superfund Site

ParameterName	Screening Values				Refinement Ecotoxicity Values														
	EPA Region 4	EPA Region 5	Approved Screening Value for Use in ERA	Data Source	NAWQC Fresh CCC	NAWQC Marine CCC	Florida SWQC Fresh	Florida SWQC Marine	EPA Ecotox Fresh	EPA Ecotox Marine	Canadian WQG Fresh	Canadian WQG Marine	Great Lakes Tier II SCV	LCV Fish	LCV Daphnids	LCV Inverte-brates	LCV Aquatic Plants	Range of Toxicity Values	Approved Refinement Value for Use in ERA	Data Source
Reference -->	a	b			c1	c2	d1	d2	e1	e2	f1	f2	g1	h1	h2	h3	h4			
Dioxins (ng/L)																				
TEQ OF 2,3,7,8-TCDD	-	0 0000003	**0.0000003**	b	-	-	-	-	-	-	-	-	-	-	-	-	-	0 - 0	-	-
Inorganics (mg/L)																				
ALUMINUM	0.087	-	**0.087**	a	*0.087*	-	-	1.5	-	-	0.005	-	-	3.288	1.9	-	0.46	0.005 - 3.288	**0.46**	h4
ANTIMONY	0 16	0.031	**0.16**	a	-	-	-	-	-	-	-	-	0.03	1.6	5 4	-	0.61	0 03 - 5 4	**0.61**	h4
ARSENIC	0.19	0.053	**0.19**	a	0.15	0 036	0.05	0 05	0 19	0 036	0 005		0 0031	0.892	0.45	-	0 048	0.0031 - 0 892	**0.048**	h4
BARIUM	-	5	**5**	b	-	-	-	-	0.0039	-	-	-	0.004	-	-	-	-	0.0039 - 0 004	**0.0039**	e1
BERYLLIUM	0.00053	7 6	**0.00053**	a	-	-	0.00013	0.00013	0 0051	-	-	-	0.00066	0.057	0 0053	-	100	0 00013 - 100	**0.0053**	h2
CADMIUM	0.00066	0.00066	**0.00066**	a	*0.0407*	0.0093	*0 00788*	0 0093	0 001	0.0093	0 000017	0.00012	-	0 0017	0.00015	-	0.002	0 000017 - 0.0407	**0.00015**	h2
CALCIUM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	116	-	-	116 - 116	**116**	h2
CHROMIUM TOTAL	0.011	0 042	**0.011**	a	0.011	0.05	0.011	0.05	0.01	0.05	0.001	0 015	-	0.06863	0.044	-	0.397	0.001 - 0.397	**0.044**	h2
COBALT	-	0.005	**0.005**	b	-	-	-	-	0.003	-	-	-	0.023	0.29	0.0051	-	-	0 003 - 0.29	**0.0051**	h2
COPPER	0.000654	0.005	**0.000654**	a	*1.13*	0.0031	*2.027*	0.0029	0 011	0.0024	0.002	-	-	0 0038	0 00023	0.00607	0 001	0.00023 - 2.027	**0.00023**	h2
IRON	1	-	**1**	a	-	-	1	0 3	1	-	0.3	-	-	1 3	0.158	-	-	0.158 - 1.3	**0.158**	h2
LEAD	0 00132	0 0013	**0.00132**	a	*0 165*	8.1	*0 255*	0 0056	0.0025	0.0081	0.001	-	-	0 0188	0.01226	0.02546	0.5	0.001 - 8.1	**0.01226**	h2
MAGNESIUM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	82	-	-	82 - 82	**82**	h2
MANGANESE	-	-	-	-	-	-	-	-	0.08	-	-	-	0.12	1.78	1.1	-	-	0 08 - 1.78	**1.1**	h2
NICKEL	0.08771	0 029	**0.08771**	a	*60.7*	0 0082	*778*	0 0083	0.16	0 082	0.025	-	-	0 035	0 005	0.1284	0.005	0.005 - 778	**0.005**	h2, h4
POTASSIUM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	53	-	-	53 - 53	**53**	h2
SELENIUM	0 005	0 005	**0.005**	a	-	-	0.005	0 071	0 005	0 071	0.001	-		0.08832	0.09165	-	0 1	0 001 - 0 1	**0.08832**	h1
SILVER	0.000012	0 001	**0.000012**	a	-	-	0 00007	-			0.0001	-	0.00038	0.00012	0.00026	-	0.03	0.00007 - 0.03	**0.00012**	h1
SODIUM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	680	-	-	680 - 680	**680**	h2
THALLIUM	0 004	0 00056	**0.004**	a	-	-	0.0063	0 0063	-	-	0 0008	-	0.012	0 057	0.13	-	0.1	0.0008 - 0.13	**0.057**	h1
VANADIUM	-	0 019	**0.019**	b	-	-	-	-	0.019	-	-	-	0 02	0.08	1.9	-	-	0 019 - 1 9	**0.08**	h1
ZINC	0.05891	0.0589	**0.05891**	a	*408.61*	0.081	*312 6*	0 086	0 1	0 081	0 03	-		0.03641	0.04673	5.243	0.03	0 03 - 408 61	**0.033641**	h1
MERCURY	0.000012	0 0000013	**0.000012**	a	0 00077	0 00094	0.012	0 025	0.0013	0 0011	0.1	-	2 8E-06	0 00052	0 00004	-	0 004	2.8E-06 - 0.1	**0.00004**	h2
CYANIDE	0 0052	0 0052	**0.0052**	a	0 0052	0 001	0.0052	0.001	0.0052	0 001	0 005	-	-	0.0078	-	0.01833	0.3	0.001 - 0.3	**0.0078**	h1
Pesticides (ug/L)																				
ALDRIN	0.3	0 0309	**0.3**	a	-	-	3	3	-	-	-	-	-	-	-	-	-	3 - 3	**3**	d1, d2
ALPHA BHC (ALPHA HEXACHLOROCYCLOHEXANE)	500	12 38	**500**	a	-	-	-	-	-	-	-	-	2.2	-	95	-	-	2.2 - 95	**95**	h2
ALPHA ENDOSULFAN (ENDOSULFAN I)	0.056	0 003	**0.056**	a	0 056	0 0087	0.056	0 0087	0 051	-	0 02	-	0 051	-	-	-	-	0 0087 - 0.056	**0.056**	d1
ALPHA-CHLORDANE	0.0043	0 00029	**0.0043**	a	0.0043	0.004	0 0043	0 0043	-	-	-	-	-	1.6	16	1.09	-	0.004 - 16	**1.09**	h3
BETA BHC (BETA HEXACHLOROCYCLOHEXANE)	5000	0.495	**5000**	a	-	-	0.0046	0 0046	-	-	-	-	2.2	-	95	-	-	0.0046 - 95	**95**	h2
BETA ENDOSULFAN (ENDOSULFAN II)	0 056	0.003	**0.056**	a	0 056	0 0087	-	-	0.051		0 02		0 051	-	-	-	-	0 0087 - 0 056	**0.051**	e1, g1
DELTA BHC (DELTA HEXACHLOROCYCLOHEXANE)	-	666 67	**666.67**	b	-	-	-	-	-		-	-	2 2	-	95	-	-	2.2 - 95	**95**	h2
DIELDRIN	0 0019	0 000026	**0.0019**	a	0 056	0 0019	0 0019	0.0019	0.062	0.11	-	-	-	-	-	-	-	0.0013 - 0.11	**0.0019**	c2, d1, d2
ENDOSULFAN SULFATE	-	2 22	**2.22**	b	-	-	-	-	0 051		-	-	0 051	-	-	-	-	0.051 - 0.051	**0.051**	e1, g1
ENDRIN	0.0023	0 002	**0.0023**	a	0 036	0 0023	0.0023	0.0023	0.061	0.01	-	-	-	-	-	-	-	0 0023 - 0 061	**0.0023**	c2, d1, d2
ENDRIN ALDEHYDE	-	0 15	**0.15**	b	-	-	-	-	-	-	-	-	-	-	-	-	-	0 - 0	-	-
ENDRIN KETONE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0 - 0	-	-
GAMMA BHC (LINDANE)	0 08	0.01	**0.08**	a			0 08	0 16	0 08	-	0 01		-	14.6	14.5	3.3	500	0 01 - 500	**3.3**	h3
GAMMA-CHLORDANE	0 0043	0 00029	**0.0043**	a	-	-	0 0043	0.0043		-	-	-	-	1.6	16	1.09	-	0.0043 - 16	**1.09**	h3
HEPTACHLOR	0 0038	0 00039	**0.0038**	a	0.0038	0 0036	0 0038	0.0036	0.0069	-	-	-	0.0069	1.26	3.18	-	26.7	0.0036 - 26.7	**1.26**	h1
HEPTACHLOR EPOXIDE	0 0038	0 00048	**0.0038**	a	0 0038	0 0036	-	-	-	-	-	-	-	-	-	-	-	0 0036 - 0.0038	**0.0037**	c1
METHOXYCHLOR	0 03	0.005	**0.03**	a	0 03	0 03	0.3	0.3	0 019	-	-	-	0 019	-	-	-	-	0.019 - 0 3	**0.3**	d1, d2
p,p'-DDD	0 001	0.0011	**0.001**	a	-	-	-	-	-	-	-	-	0 011	1 69	-	-	-	0.011 - 1 69	**1.69**	h1
p,p'-DDE	10.5	4 51E-09	**10.5**	a	-	-	-	-	-	-	-	-						0 - 0	-	-
p,p'-DDT	0 0064	0.001	**0.0064**	a	0 001	0.001	0 001	0.001	0 013	-	-	-	0.013	0 73	0.016	-	0.3	0 001 - 0.73	**0.016**	h2
TOXAPHENE	0 0002	0.0002	**0.0002**	a	0 0002	0 0002	0.0002	0.0002	0 011	0 21	-	-	-	-	-	-	-	0.0002 - 0.21	**0.0002**	c2., d1, c
PCBs (ug/L)																				
PCB-1016 (AROCHLOR 1016)	0 014	0.000029	**0.014**	a	0 014	0 03	0.014	0.03	0.19	-	-	-	-	-	-	-	-	0.014 - 0 19	**0.014**	c1, d1
PCB-1221 (AROCHLOR 1221)	0.014	0.000029	**0.014**	a	0 014	0 03	0.014	0.03	0.19	-	-	-	0 28	60	-	-	-	0.014 - 60	**60**	h1
PCB-1232 (AROCHLOR 1232)	0 014	0 000029	**0.014**	a	0 014	0 03	0 014	0 03	0 19	-	-	-	0.58	124	-	-	-	0.014 - 124	**124**	h1
PCB-1242 (AROCHLOR 1242)	0.014	0 000029	**0.014**	a	0 014	0 03	0 014	0 03	0.19	-	-	-	0 053	9	-	-	-	0 014 - 9	**9**	h1
PCB-1248 (AROCHLOR 1248)	0.014	0 000029	**0.014**	a	0 014	0 03	0.014	0.03	0.19	-	-	-	0.0814	-	-	-	-	0 014 - 0.19	**0.014**	c1, d1
PCB-1254 (AROCHLOR 1254)	0 014	0 000029	**0.014**	a	0.014	0 03	0 014	0.03	0.19	-	-	-	0 033	-	-	-	-	0 014 - 0.19	**0.014**	c1, d1
PCB-1260 (AROCHLOR 1260)	0 014	0.000029	**0.014**	a	0 014	0 03	0.014	0.03	0.19	-	-	-	94	1 3	-	-	-	0 014 - 94	**1.3**	h1
Volatile Organic Compounds (ug/L)																				
1,1,1-TRICHLOROETHANE	528	88	**528**	a	-	-	-	-	62	-	-	-	11	3493	-	-	669000	11 - 669000	**3493**	h1
1,1,2,2-TETRACHLOROETHANE	240	13	**240**	a	-	-	10 8	10.8	420	-	111	-	610	2400	9900	-	136000	10 8 - 136000	**2400**	h1
1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0 - 0	-	-
1,1,2-TRICHLOROETHANE	940	650	**940**	a	-	-	-	-	-	-	21	-	1200	9400	18400	-	-	21 - 18400	**9400**	h1
1,1-DICHLOROETHANE	-	47	**47**	b	-	-	-	-	47	-	-	-	47	14680		-	-	47 - 14680	**14680**	h1
1,1-DICHLOROETHENE	303	78	**303**	a	-	-	3 2	3 2	-	-	-	-	25	2800	4720	-	798000	3 2 - 798000	**2800**	h1
1,2,4-TRICHLOROBENZENE	44.9	69.2	**44.9**	a	-	-	-	-	110	-	24	5 4	110	-	-	-	-	5 4 - 110	**110**	e1, g1
1,2-DIBROMO-3-CHLOROPROPANE	-	11.2	**11.2**	b	-	-	-	-	-	-	-	-	-	-	-	-	-	0 - 0	-	-
1,2-DICHLOROBENZENE	15 8	87	**15.8**	a	-	-	-	-	14	-	0 7	42	14	-	-	-	-	0.7 - 42	**14**	e1, g1
1,2-DICHLOROETHANE	2000	190	**2000**	a	-	-	-	-	-	-	100	-	910	41364	15200	-	-	100 - 41364	**[redacted]**	h2
1,2-DICHLOROPROPANE	525	380	**525**	a	-	-	-	-	-	-				-	-	-	-	0 - 0	-	-
1,3-DICHLOROBENZENE	50.2	11	**50.2**	a	-	-	-	-	71	-	150	-	71	-	-	-	-	7.1 - 150	**[redacted]**	e1, g1
1,4-DICHLOROBENZENE	11.2	43	**11.2**	a	-	-	-	-	15	-	26	-	15	-	-	-	-	15 - 26	**[redacted]**	e1, g1
2-HEXANONE	-	1710	**1710**	b	-	-	-	-	-	-	-	-	99	0.0783	-	-	-	0.0783 - 99	**[redacted]**	h1
4-BROMOFLUOROBENZENE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0 - 0	-	-
ACETONE	-	78000	**78000**	b	-	-	-	-	-	-	-	-	1500	507640	1560	-	-	1500 - 507640	**1560**	h2

Table 2-3
Approved Ecotoxicity Values for [redacted]ng and Refinement in the ERA: Freshwater
Browns Dump Superfund Site

ParameterName	Screening Values				Refinement Ecotoxicity Values														
	EPA Region 4	EPA Region 5	Approved Screening Value for Use in ERA	Data Source	NAWQC Fresh CCC	NAWQC Marine CCC	Florida SWQC Fresh	Florida SWQC Marine	EPA Ecotox Fresh	EPA Ecotox Marine	Canadian WQG Fresh	Canadian WQG Marine	Great Lakes Tier II SCV	LCV Fish	LCV Daphnids	LCV Invertebrates	LCV Aquatic Plants	Range of Toxicity Values	Approved Refinement Value for Use in ERA	Data Source
Reference -->	a	b			c1	c2	d1	d2	e1	e2	f1	f2	g1	h1	h2	h3	h4			
BENZENE	53	114	53	a	-	-	71.28	71.28	0.046	-	370	110	130	-	98000	-	525000	0.046 - 525000	98000	h2
BROMODICHLOROMETHANE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0 - 0	-	-
BROMOFORM	293	466	293	a	-	-	360	360	-	-	-	-	-	-	-	-	-	360 - 360	360	d1, d2
BROMOMETHANE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0 - 0	-	-
CARBON DISULFIDE	-	84.1	84.1	b	-	-	-	-	-	-	-	-	0.92	9538	244	-	-	0.92 - 9538	244	h2
CARBON TETRACHLORIDE	352	5.9	352	a	-	-	4.42	4.42	-	-	13.3	-	9.8	1970	5580	-	-	4.42 - 5580	1970	h1
CHLOROBENZENE	195	10	195	a	-	-	-	-	130	-	-	-	64	1203	15042	-	224000	64 - 224000	1203	h1
CHLOROETHANE	-	230000	230000	b	-	-	-	-	-	-	-	-	-	-	-	-	-	0 - 0	-	-
CHLOROFORM	289	79	289	a	-	-	470.8	470.8	-	-	1.8	-	28	1240	4483	-	-	1.8 - 4483	1240	h1
CHLOROMETHANE	-	-	-	-	-	-	470.8	470.8	-	-	-	-	-	-	-	-	-	470.8 - 470.8	470.8	d1, d2
cis-1,2-DICHLOROETHYLENE	-	310	310	b	-	-	-	-	-	-	-	-	-	-	-	-	-	0 - 0	-	-
cis-1,3-DICHLOROPROPENE	24.4	7.9	24.4	a	-	-	-	-	-	-	-	-	-	-	-	-	-	0 - 0	-	-
DIBROMOCHLOROMETHANE	-	6400	6400	b	-	-	34	34	-	-	-	-	-	-	-	-	-	34 - 34	34	d1, d2
DIBROMOFLUOROMETHANE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0 - 0	-	-
DICHLORODIFLUOROMETHANE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0 - 0	-	-
ETHYLBENZENE	453	17.2	453	a	-	-	-	-	290	-	90	-	7.3	440	12922	-	438000	7.3 - 438000	440	h1
ETHYLENE DIBROMIDE (1,2-DIBROMOETHANE)	-	22.5	22.5	b	-	-	-	-	-	-	-	-	-	-	-	-	-	0 - 0	-	-
ISOPROPYLBENZENE (CUMENE)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0 - 0	-	-
M,P-XYLENE	-	117	117	b	-	-	-	-	1.8	-	-	-	1.8	-	-	-	-	1.8 - 1.8	1.8	e1, g1
METHYL ETHYL KETONE (2-BUTANONE)	-	7100	7100	b	-	-	-	-	-	-	-	-	14000	282170	1394927	-	-	14000 - 1394927	282170	h1
METHYL ISOBUTYL KETONE (4-METHYL-2-PENTANON	-	3680	3680	b	-	-	-	-	-	-	-	-	170	77400	-	-	-	170 - 77400	77400	h1
METHYL tert-BUTYL ETHER	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0 - 0	-	-
METHYLENE CHLORIDE	1930	430	1930	a	-	-	1580	1580	-	-	98.1	-	2200	108000	42667	-	-	98.1 - 108000	42667	h2
O-XYLENE	-	117	117	b	-	-	-	-	-	-	-	-	13	62308	-	-	-	13 - 62308	62308	h1
STYRENE	-	56	56	b	-	-	-	-	-	-	0.072	-	-	-	-	-	-	0.072 - 0.072	0.072	f1
TETRACHLOROETHYLENE(PCE)	84	8.9	84	a	-	-	-	-	120	-	111	-	98	840	750	-	816000	98 - 816000	750	h2
TRICHLOROETHYLENE (TCE)	-	75	75	b	-	-	80.7	80.7	350	-	21	-	47	11100	7257	-	-	21 - 11100	7257	h2
TOLUENE	175	253	175	a	-	-	-	-	130	-	2	-	9.8	1269	25229	-	245000	2 - 245000	1269	h1
Semivolatile Organic Compounds (ug/L)																				
1-METHYLNAPHTHALENE	-	-	-	-	-	-	-	-	-	-	-	-	2.1	526	-	-	-	2.1 - 526	526	h1
2,4,5-TRICHLOROPHENOL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0 - 0	-	-
2,4,6-TRICHLOROPHENOL	3.2	2	3.2	a	-	-	-	-	-	-	-	-	-	-	-	-	-	0 - 0	-	-
2,4-DICHLOROPHENOL	35.6	18	35.6	a	-	-	790	790	-	-	-	-	-	-	-	-	-	790 - 790	790	d1, d2
2,4-DIMETHYLPHENOL	21.2	100.17	21.2	a	-	-	-	-	-	-	-	-	-	-	-	-	-	0 - 0	-	-
2,4-DINITROPHENOL	6.2	4.07	6.2	a	-	-	14260	14260	-	-	-	-	-	-	-	-	-	14260 - 14260	14260	d1, d2
2,4-DINITROTOLUENE	310	230	310	a	-	-	9.1	9.1	-	-	-	-	-	-	-	-	-	9.1 - 9.1	9.1	d1, d2
2,6-DINITROTOLUENE	-	42	42	b	-	-	-	-	-	-	-	-	-	-	-	-	-	0 - 0	-	-
2-CHLORONAPHTHALENE	-	0.396	0.396	b	-	-	-	-	-	-	-	-	-	-	-	-	-	0 - 0	-	-
2-CHLOROPHENOL	43.8	8.8	43.8	a	-	-	400	400	-	-	-	-	-	-	-	-	-	400 - 400	400	d1, d2
2-METHYLNAPHTHALENE	-	329.55	329.55	b	-	-	-	-	-	-	-	-	-	-	-	-	-	0 - 0	-	-
2-METHYLPHENOL (o-CRESOL)	-	-	-	-	-	-	-	-	-	-	-	-	13	489	1316	-	-	13 - 1316	489	h1
2-NITROANILINE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0 - 0	-	-
2-NITROPHENOL	3500	13.5	3500	a	-	-	-	-	-	-	-	-	-	-	-	-	-	0 - 0	-	-
3,3'-DICHLOROBENZIDINE	-	99.75	99.75	b	-	-	-	-	-	-	-	-	-	-	-	-	-	0 - 0	-	-
3-NITROANILINE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0 - 0	-	-
4,6-DINITRO-2-METHYLPHENOL	2.3	-	2.3	a	-	-	-	-	-	-	-	-	-	-	-	-	-	0 - 0	-	-
4-BROMOPHENYL PHENYL ETHER	12.2	1.5	12.2	a	-	-	-	-	1.5	-	-	-	1.5	-	-	-	-	1.5 - 1.5	1.5	e1, g1
4-CHLORO-3-METHYLPHENOL	0.3	-	0.3	a	-	-	-	-	-	-	-	-	-	-	-	-	-	0 - 0	-	-
4-CHLOROANILINE	-	231.97	231.97	b	-	-	-	-	-	-	-	-	-	-	-	-	-	0 - 0	-	-
4-CHLOROPHENYL PHENYL ETHER	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0 - 0	-	-
4-NITROANILINE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0 - 0	-	-
4-NITROPHENOL	82.8	35	82.8	a	-	-	-	-	-	-	-	-	300	481	7100	-	4190	300 - 7100	481	h1
ACENAPHTHENE	17	9.9	17	a	-	-	2700	2700	23	40	5.8	-	-	74	6646	227	520	5.8 - 6646	74	h1
ACENAPHTHYLENE	-	48400	48400	b	-	-	-	-	-	-	-	-	-	-	-	-	-	0 - 0	-	-
ANTHRACENE	-	0.029	0.029	b	-	-	110000	110000	-	-	0.012	-	0.73	0.09	2.1	-	-	0.012 - 110000	0.09	h1
BENZO(a)ANTHRACENE	-	0.839	0.839	b	-	-	-	-	-	-	0.018	-	0.027	-	0.65	-	-	0.018 - 0.65	0.65	h2
BENZO(a)PYRENE	-	0.014	0.014	b	-	-	-	-	0.014	-	0.015	-	0.014	-	0.3	-	-	0.014 - 0.3	0.3	h2
BENZO(b)FLUORANTHENE	-	9.07	9.07	b	-	-	-	-	-	-	-	-	-	-	-	-	-	0 - 0	-	-
BENZO(g,h,i)PERYLENE	-	7.64	7.64	b	-	-	-	-	-	-	-	-	-	-	-	-	-	0 - 0	-	-
BENZO(k)FLUORANTHENE	-	0.0056	0.0056	b	-	-	-	-	-	-	-	-	-	-	-	-	-	0 - 0	-	-
BENZYL BUTYL PHTHALATE	22	49	22	a	-	-	-	-	19	-	-	-	19	-	-	-	-	19 - 19	19	e1, g1
bis(2-CHLOROETHOXY) METHANE	-	6400	6400	b	-	-	-	-	-	-	-	-	-	-	-	-	-	0 - 0	-	-
bis(2-CHLOROETHYL) ETHER (2-CHLOROETHYL ETHE	2380	1140	2380	a	-	-	-	-	-	-	-	-	-	-	-	-	-	0 - 0	-	-
bis(2-CHLOROISOPROPYL) ETHER	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0 - 0	-	-
bis(2-ETHYLHEXYL) PHTHALATE	0.3	2.1	0.3	a	-	-	-	-	32	-	-	-	3	-	912	-	-	3 - 912	912	h2
CARBAZOLE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0 - 0	-	-
CHRYSENE	-	0.033	0.033	b	-	-	-	-	-	-	-	-	-	-	-	-	-	0 - 0	-	-
CRESOLS, M&P	-	34.79	34.79	b	-	-	-	-	-	-	-	-	-	-	-	-	-	0 - 0	-	-
DIBENZ(a,h)ANTHRACENE	-	0.0016	0.0016	b	-	-	-	-	-	-	-	-	-	-	-	-	-	0 - 0	-	-
DIBENZOFURAN	-	20	20	b	-	-	-	-	20	-	-	-	3.7	-	1003	-	-	3.7 - 1003	1003	h2
DIETHYL PHTHALATE	521	3	521	a	-	-	-	-	220	-	-	-	210	-	-	-	85600	210 - 85600	85600	h4
DIMETHYL PHTHALATE	330	73	330	a	-	-	-	-	-	-	-	-	-	-	-	-	-	0 - 0	-	-
DI-n-BUTYL PHTHALATE	9.4	3	9.4	a	-	-	-	-	33	-	19	-	35	717	697	-	-	19 - 717	697	h2
DI-n-OCTYLPHTHALATE	-	30	30	b	-	-	-	-	-	-	-	-	-	3822	708	-	-	708 - 3822	708	h2

3 12 0209

Table 2-3
Approved Ecotoxicity Value[illegible]reening and Refinement in the ERA: Freshwater
Br[illegible] Dump Superfund Site

ParameterName	*Screening Values*				*Refinement Ecotoxicity Values*															
	EPA Region 4	EPA Region 5	Approved Screening Value for Use in ERA	Data Source	NAWQC Fresh CCC	NAWQC Marine CCC	Florida SWQC Fresh	Florida SWQC Marine	EPA Ecotox Fresh	EPA Ecotox Marine	Canadian WQG Fresh	Canadian WQG Marine	Great Lakes Tier II SCV	LCV Fish	LCV Daphnids	LCV Inverte-brates	LCV Aquatic Plants	Range of Toxicity Values	Approved Refinement Value for Use in ERA	Data Source
Reference -->	a	b			c1	c2	d1	d2	e1	e2	f1	f2	g1	h1	h2	h3	h4			
FLUORANTHENE	39.8	8.1	**39.8**	a	-	-	370	370	8.1	11	0.04	-	-	30	15	-	54400	0.04 - 54400	**15**	h2
FLUORENE	-	3.9	**3.9**	b	-	-	14000	14000	3.9	-	3	-	3.9	-	-	-	-	3 - 14000	**14000**	d1, d2
HEXACHLOROBENZENE	-	0.00024	**0.00024**	b	-	-	-	-	-	-	-	-	-	-	-	-	-	0 - 0	-	-
HEXACHLOROBUTADIENE	0.93	0.223	**0.93**	a	-	-	49.7	49.7	-	-	1.3	-	-	-	-	-	-	1.3 - 49.7	**49.7**	d1, d2
HEXACHLOROCYCLOPENTADIENE	0.07	77.04	**0.07**	a	-	-	-	-	-	-	-	-	-	-	-	-	-	0 - 0	-	-
HEXACHLOROETHANE	9.8	30.5	**9.8**	a	-	-	-	-	12	-	-	-	12	-	-	-	-	12 - 12	**12**	e1, g1
INDENO(1,2,3-c,d)PYRENE	-	4.31	**4.31**	b	-	-	-	-	-	-	-	-	-	-	-	-	-	0 - 0	-	-
ISOPHORONE	1170	900	**1170**	a	-	-	-	-	-	-	-	-	-	-	-	-	-	0 - 0	-	-
NAPHTHALENE	62	44	**62**	a	-	-	-	-	24	-	1.1	-	12	620	1163		33000	1.1 - 33000	**620**	h1
NITROBENZENE	270	740	**270**	a	-	-	-	-	-	-	-	-	-	-	-	-	-	0 - 0	-	-
N-NITROSODI-n-PROPYLAMINE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0 - 0	-	-
N-NITROSODIPHENYLAMINE	58.5	13	**58.5**	a	-	-	-	-	-	-	-	-	210	332	1042	-	-	210 - 1042	**332**	h1
PENTACHLOROPHENOL	13	5.23	**13**	a	15	7.9	30	7.9	13	7.9	1	-	-	-	-	-	-	1 - 30	**30**	d1
PHENANTHRENE	-	2.1	**2.1**	b	-	-	-	-	6.3	8.3	0.4	-	-	-	200	-	-	0.4 - 200	**200**	h2
PHENOL	256	100	**256**	a	-	-	300	300	-	-	4	-	-	200	2005	-	20000	4 - 20000	**200**	h1
PYRENE	-	0.3	**0.3**	b	-	-	11000	11000	-	-	0.025	-	-	-	-	-	-	0.025 - 11000	**11000**	d1, d2

Notes:

1. Italicized inorganic refinement values (NAWQC and Florida Freshwater) are hardness dependant. Calculations are based on equation in reference and average water hadness as (CaCO3) fo 266.8 mg/L from Table 2-4.

References:

a) EPA 1999 U.S. Environmental Protection Agency Region 4 Ecological Risk Assessment Bulletins – Supplemental to RAGS – Draft. August 11, 1999
b) EPA 1999. EPA Region 5 RCRA Ecological Data Quality Levels (EDQLs), Updated April 1999
c1) EPA 1999. U.S. Environmental Protection Agency, Office of Water. National Ambient Water Quality Croitena - Correction. EPA822-Z-99-001. April 1999. Freshwater CCC.
c2) EPA 1999 U.S. Environmental Protection Agency, Office of Water. National Ambient Water Quality Croiteria - Correction. EPA822-Z-99-001. April 1999. Saltwater CCC
d1) FDEP, 2000. Florida Department of Environmental Protection, Florida Administrative Code, Chapter 62-302 Surface Water Quality Standards - Freshwater Values
d2) FDEP, 2000. Florida Department of Environmental Protection, Florida Administrative Code, Chapter 62-302 Surface Water Quality Standards - Marine Values
e1) USEPA 1996 Eco Update (Ecotox Thresholds). Interim Bulletin Volume 3, Number 2. EPA 540/f-95/038, January 1996 - Freshwater Surface Water Values
e2) USEPA 1996. Eco Update (Ecotox Thresholds) Interim Bulletin Volume 3, Number 2. EPA 540/f-95/038, January 1996 - Marine Surface Water Values
f1) CCMOE, 1999. Canadian Council of Ministers of the Environment, Canadian Environmental Quality Guidelines, Canadian Water Quality Guidelines for the Protection of Aquatic Life – Summary Tables, 1999 - Freshwater Values
f1) CCMOE, 1999. Canadian Council of Ministers of the Environment, Canadian Environmental Quality Guidelines, Canadian Water Quality Guidelines for the Protection of Aquatic Life – Summary Tables, 1999 - Marine Values.
g1) EPA 1993. Water Quality Guidance for the Great Lakes System and Correctoin: Proposed Rules Federal Register 58(72):20802-21047.
h1) Suter and Tsao, 1996. Suter II, G.W., and Tsao, C.L., Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Aquatic Biota: 1996 Revision, U.S. Department of Energy - Table 1. Lowest Chronic Values for Fish
h2) Suter and Tsao, 1996 Suter II, G.W., and Tsao, C.L., Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Aquatic Biota: 1996 Revison, U.S. Department of Energy - Table 1. Lowest Chronic Values for Daphnids
h3) Suter and Tsao 1996 Suter II, G.W., and Tsao, C.L., Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Aquatic Biota: 1996 Revision, U.S. Department of Energy - Table 1 Lowest Chronic Values for Non-Daphnid Invertebrates
h4) Suter and Tsao, 1996. Suter II, G.W., and Tsao, C.L., Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Aquatic Biota: 1996 Revision, U.S. Department of Energy - Table 1 Lowest Chronic Values for Aquatic Plants

3 12 0210

Table 2-4
Surface Soil Sample Results and Selection of PCOPEC and COPEC
Browns Dump Superfund Site
Page 1 of 5

ParameterName	BDSB005		BDSB009		BDSB017		BDSB014		BDSB018		BDSB030		BDSB031		BDSB034		BDSB035		BDSB036		BDSB038		BDSB039		BDSB040		BDSB041		BDSB042		BDSB043		BDSB044		BDSB045		BDSB046		BDSB054		BDSB055		BDSB058		BDSB060		BDSB063	
	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
Dioxins (ng/KG)																																															
TEQ OF 2,3,7,8-TCDD																							27	=																								
Inorganics (mg/KG)																																															
ALUMINUM	2100	=	27000	=	6200	=	1100	=	7500	=					2500	=	2300	=	2100	=	1900	=	3000	=	4800	=	5810	J	1800	=	1800	=	2900	=	2900	=	1800	=	2200	J	1800	J	1800	=			2100	=
ANTIMONY		UJ	63	J	13	J		UJ	0 86	J						UJ	0 92	J		U		UJ	0 74	J		UJ		UJ		U		U		U		U		U	19	J	2 3	J	7.4	J	12	J	12	J				U
ARSENIC	0 76	J	14	=	2 6	=	3 4	=	6 7	=					0 59	J	0 97	J	0 62	J		U	1 3	J	3 5	=	7 4	J	1 2	J	0 95	J	0 75	J	4 1	=	1 8	=	12	=	15	=	2 1	=			2	J
BARIUM	61	J	550	J	810	J	45	=	76	=					13	J	57	=	25	J	9 4	J	29	J	33	J	45	J	23	J	10	J	7 4	J	500	=	150	=	310	=	820	=	120	=			47	=
BERYLLIUM		U	0 55	J	0 68	J	0 09	J	0 44	J					0 086	J	0 085	J		U		U	0 1	J	0 27	J	0 34	J		U		U		U	0 035	J	0 05	J	0 092	J	0 078	J		U	0 083	J
CADMIUM	0 31	J	3.8	=	3.2	=	0 99	=	1 3	=						U	2	=	0 56	J	0 11	J	0 36	J	0 65	J	0 8	J	0 42	J	0 18	J		U	7.2	=	1.6	=	4.3	=	2	=	1.2	=			1 2	=
CALCIUM	15000	=	11000	=	49000	=	3200	=	12000	=					7100	=	5900	=	4100	=	8100	=	7700	=	6900	=	15100	J	15000	=	31000	=	6100	=	3600	=	2100	=	36000	=	7000	=	2300	=			12000	=
CHROMIUM, TOTAL	5.8	J	30	J	66	J	9.9	J	27	=					5.8	=	6.3	=	4.9	=	3 8	J	6.3	=	15	J	21.1	J	5.5	=	4.4	=	3.9	=	22	=	11	=	31	=	15	=	6.9	=			6.7	=
COBALT	0 47	J	4	J	2 8	J	0 96	J	2	J						U	0 45	J	0 43	J		U	0 34	J	1 2	J	2 5	J	0 47	J	0 49	J		U	2 4	J	1 3	J	4 2	J	2	J	0 72	J			0 63	J
COPPER	20	J	230	J	200	J	40	J	67	=					11	=	21	=	28	=	5 9	J	26	=	22	J	53	J	16	=	5	=	2 3	J	200	=	65	=	150	=	120	=	32	=			22	=
IRON	3000	=	6100	=	12000	=	8900	=	15000	=					1700	=	2700	=	2000	=	1200	=	2800	=	7600	=	12900	J	2500	=	1900	=	1000	=	9100	=	6500	=	47000	=	14000	=	4700	=			3700	=
LEAD	130	=	43000	=	1300	=	280	=	190	J	93	=	82.2	=	12	J	120	=	90	=	22	=	80	=	89	=	139	=	96	=	35	=	28	=	2100	J	240	J	630	=	840	=	710	J			170	=
MAGNESIUM	310	J	2400	=	6300	=	220	J	3500	=					770	J	200	J	160	J	140	J	290	J	1400	J	6490	J	440	J	430	J	150	J	690	J	520	J	910	J	720	J	190	J			440	J
MANGANESE	24	=	180	J	390	J	47	=	140	=					19	=	80	J	60	J	20	=	75	J	290	=	218	J	36	J	27	=	9 3	=	150	=	95	=	390	=	130	=	73	=			69	J
NICKEL	2 9	J	29	=	18	=	4 2	J	8 2	J						U	2	J	2 4	J	0 82	J	2 3	J	5 4	J	4 6	J	3 4	J	1 7	J	1	J	17	=	8 3	=	27	=	13	=	4 6	J			3 3	J
POTASSIUM	80	J	2500	J	710	J	190	J	1100	J					120	J	110	J	89	J	68	J	120	J	450	J	760	J	130	J	100	J	78	J	120	J	230	J	160	J	83	J	70	J			100	J
SILVER		U	1 6	J	0 37	J		U	0 53	J						U		U		U		U		U	0 28	J		U		U		U	0 97	J	0 36	J	0 86	J	0 62	J	0 21	J				U
SODIUM		U	1100	J	290	J		U		U						U		U		U		U		U	121	J		U	50	J		U		U		U	370	J		U		U				U
VANADIUM	5.4	J	85	=	8.7	J	4.4	J	20	=					5.1	J	6.3	J	5	J	3.9	J	8.1	J	18	=	18.1	=	6.4	J	5.7	J	4.3	J	9.8	J	12	=	16	=	6.8	J	6.1	J			5.8	J
ZINC	120	=	5200	=	870	=	260	=	410	=					22	=	150	=	180	=	36	=	120	=	93	=	103	=	120	=	37	=	12	=	1400	=	300	=	1200	=	820	=	1000	=			170	=
MERCURY	0 042	J	0 061	J	0.11	=	0 041	J	0.22	J					0 018	J	0 03	J	0 02	J	0 071	J	0 13	=	0.25	=	0.42	=	0.18	=	0.13	=	0 035	J	0.17	=	0 097	=	13	=	0.19	=	0 044	J			0 08	J
THALLIUM																							0 38	J																								
CYANIDE		U		U	1.1	J		U	1	J					0 69	J	0 07	J	0 06	J		U	0 1	J		U	0 14	J	0 28	J		U		U	0 76	J	0 79	=	2.2	J	1.1	J	0 71	J			0 06	J
Pesticides (ug/KG)																																															
ALDRIN				U	180	=		U															R												U												
ALPHA-CHLORDANE				U		U		U															R												U												
DIELDRIN				U		U		U															R												U												
ENDRIN				U		U		U															R												U												
GAMMA-CHLORDANE				U	460	=		U															R												U												
HEPTACHLOR EPOXIDE				U		U		U															R												U												
p,p'-DDD				U		U		U															R												U												
p,p'-DDE				U	380	=		U															R												U												
p,p'-DDT				U	1000	=		U															R												110	J												
PCBs (ug/KG)																																															
PCB-1260 (AROCHLOR 1260)				R		R		R															27	=												R												
Volatile Organic Compounds (ug/KG)																																															
2-HEXANONE				R		U		U																												U												
ACETONE				R	62	J	42	J																												U								56	J				
BENZENE				R	2	J		U																											0 7	J								0 6	J				
CARBON DISULFIDE				R	9	J	14	=																												U												
CHLOROFORM				R		U		U																												U												
ETHYLBENZENE				R	0 2	J		U																												U								0 3	J				
M,P-XYLENE				R	0 5	J		U																											0 5	J								0 6	J				
METHYL ETHYL KETONE (2-BUTANONE)				R	16	=		U																												U								4	J				
METHYLENE CHLORIDE				R	5	J		U																												U												
O-XYLENE				R		U		U																												U												
TOLUENE				R	1	J		U																												U								2	J				
TRICHLOROETHYLENE (TCE)				R		U		U																												U								0 7	J				
XYLENES, TOTAL				R		U		U																												U								0 6	J				
Semivolatile Organic Compounds (ug/KG)																																															
ANTHRACENE				U		U	190	J																U											170	J								120	J				
BENZO(a)ANTHRACENE				U	340	J	200	J															160	J											440	=								590	=				
BENZO(a)PYRENE				U	320	J	170	J															170	J											440	=								640	=				
BENZO(b)FLUORANTHENE				U	330	J	200	J															190	J											430	=								700	=				
BENZO(g,h,i)PERYLENE				U	170	J	95	J																U											300	J								390	=				
BENZO(k)FLUORANTHENE				U	740	J	150	J															190	J											350	J								570	=				
BENZYL BUTYL PHTHALATE				U		U		U																U												U												
bis(2-ETHYLHEXYL) PHTHALATE				U	130	J		U																U											380	=												
CARBAZOLE				U		U		U																U											79	J												
CHRYSENE				U	330	J	570	=															170	J											460	=								660	=				
DIBENZ(a,h)ANTHRACENE				U		U		U																U												U								130	J				
DI-n-BUTYL PHTHALATE				U		U		U																U												U												
DI-n-OCTYLPHTHALATE				U		U		U																U												U												
FLUORANTHENE				U	580	=	340	J															280	J											990	=								1100	=				
INDENO(1,2,3-c,d)PYRENE				U	160	J	90	J																U											270	J								360	=				
PHENANTHRENE				U	230	J	170	J															110	J											600	=								400	=				
PYRENE				U	370	J	220	J															160	J											600	=								660	=				

-, Unqualified
U, Undetected
J, Estimated value
R, Data was rejected
Samples shown in yellow exceed screening value
Samples shown in orange exceed refinement value
Screened COPEC are blacked out

10/18/2002

3 12 0211

Samples from Areas of Expected Contaminatio

ParameterName	BDSB064 Result	Q	BDSB066 Result	Q	BDSB070 Result	Q	BDSB071 Result	Q	BDSB073 Result	Q	BDSB077 Result	Q
Dioxins (ng/KG)												
TEQ OF 2,3,7,8-TCDD							3.9	=				
Inorganics (mg/KG)												
ALUMINUM	1900	=	2100	=	930	=	770	=	1700	=	1800	=
ANTIMONY	0.52	J		U	1.4	J		U		U		U
ARSENIC	0.53	J	1.1	J	0.56	J	0.81	J	1.4	J	1	J
BARIUM	12	J	15	J	5.5	J	17	J	30	J	59	=
BERYLLIUM	0.07	J	0.063	J		U		U		U		U
CADMIUM	0.38	J	0.36	J		U	0.29	J	0.55	J	0.61	J
CALCIUM	14000	=	22000	=	7300	=	8900	=	890	J	2200	=
CHROMIUM TOTAL	4.8	=	4.9	=	1.3	J	3.2	=	8.4	=	6.8	=
COBALT	0.32	J	0.32	J		U	0.51	J	0.5	J	0.49	J
COPPER	9.2	=	7.6	=	2.9	J	8.9	=	19	=	23	=
IRON	2800	=	3300	=	480	=	1500	=	2800	=	2300	=
LEAD	210	=	110	=	5.4	=	29	=	88	=	110	=
MAGNESIUM	370	J	370	J	86	J	220	J	79	J	140	J
MANGANESE	41	J	34	J	7.2	=	19	=	76	=	52	=
NICKEL	2.2	J	2.2	J	0.59	J	2.2	J	2.2	J	2.2	J
POTASSIUM	97	J	98	J	21	J	50	J	44	J	91	J
SILVER		U		U		U		U		U		U
SODIUM		U		U		U		U		U		U
VANADIUM	8.1	J	5.8	J	1.8	J	3.5	J	5.2	J	4.2	J
ZINC	98	=	62	=	26	=	55	=	100	=	140	=
MERCURY		U	0.87	=	0.035	J	0.061	J	0.053	J	0.057	J
THALLIUM												
CYANIDE	0.08	J	0.07	J		U		U		U		U
Pesticides (ug/KG)												
ALDRIN								UJ				
ALPHA-CHLORDANE								UJ				
DIELDRIN								UJ				
ENDRIN								UJ				
GAMMA-CHLORDANE								UJ				
HEPTACHLOR EPOXIDE								UJ				
p,p'-DDD								UJ				
p,p'-DDE								UJ				
p,p'-DDT								UJ				
PCBs (ug/KG)												
PCB-1260 (AROCHLOR 1260)								UJ				
Volatile Organic Compounds (ug/KG)												
2-HEXANONE												
ACETONE												
BENZENE												
CARBON DISULFIDE												
CHLOROFORM												
ETHYLBENZENE												
M,P-XYLENE												
METHYL ETHYL KETONE (2-BUTANONE)												
METHYLENE CHLORIDE												
O-XYLENE												
TOLUENE												
TRICHLOROETHYLENE (TCE)												
XYLENES, TOTAL												
Semivolatile Organic Compounds (ug/KG)												
ANTHRACENE								U				
BENZO(a)ANTHRACENE							220	J				
BENZO(a)PYRENE							260	J				
BENZO(b)FLUORANTHENE							300	J				
BENZO(g,h,i)PERYLENE							240	J				
BENZO(k)FLUORANTHENE							240	J				
BENZYL BUTYL PHTHALATE								U				
bis(2-ETHYLHEXYL) PHTHALATE								U				
CARBAZOLE								U				
CHRYSENE							320	J				
DIBENZ(a,h)ANTHRACENE							76	J				
DI-n-BUTYL PHTHALATE							40	J				
DI-n-OCTYLPHTHALATE								U				
FLUORANTHENE							360	=				
INDENO(1,2,3-c,d)PYRENE							190	J				
PHENANTHRENE							63	J				
PYRENE							410	=				

ParameterName	BDSB078 Result	Q	BDSB079 Result	Q	BDSB085 Result	Q	BDSB086 Result	Q	BDSB088 Result	Q	BDSB090 Result	Q
Dioxins (ng/KG)												
TEQ OF 2,3,7,8-TCDD			0.8629	=			2.5	=				
Inorganics (mg/KG)												
ALUMINUM	1500	=	8300	=	2700	=	1300	=	1400	=	2100	J
ANTIMONY	0.55	J		UJ	0.63	J		UJ		UJ		UJ
ARSENIC	1.2	J	1.8	J	4.8	=		U		U	1.2	J
BARIUM	26	J	29	J	75	=	11	J	13	J	13	J
BERYLLIUM		U	0.26	J	0.25	J		U		U	0.065	J
CADMIUM	0.6	J	0.27	J	0.79	J	0.19	J	0.2	J	0.12	J
CALCIUM	9600	=	7300	=	10000	=	2000	=	1100	=	1500	=
CHROMIUM TOTAL	7.5	=	9.5	=	7.2	=	4.4	J	4.5	J	4.8	=
COBALT	1	J	0.97	J	1	J	0.36	J	0.36	J	0.43	J
COPPER	13	=	11	J	48	J	11	J	12	J	5	J
IRON	2500	=	8400	=	7500	=	1800	=	1600	=	3400	=
LEAD	84	=	44	J	180	J	36	=	80	=	22	=
MAGNESIUM	310	J	600	J	1100	=	140	J	110	J	270	J
MANGANESE	85	J	24	=	120	=	68	=	56	=	22	=
NICKEL	3.4	J	2.5	J	4	J	2.7	J	1.8	J	1.4	J
POTASSIUM	87	J	450	J	210	J	66	J	55	J	140	J
SILVER		U		U		U		U		U		U
SODIUM		U		UJ		UJ		U		U		U
VANADIUM	3.7	J	13	=	5.5	J	4.1	J	4.1	J	5.3	J
ZINC	220	=	60	=	370	=	75	=	96	=	34	=
MERCURY	0.03	J	0.0041	J	0.09	J	0.042	J	0.039	J	0.046	J
THALLIUM												
CYANIDE	0.12	J	0.12	J	0.41	J		U		U	1.5	J
Pesticides (ug/KG)												
ALDRIN				U						U		
ALPHA-CHLORDANE				U					200	=		
DIELDRIN				U					100	J		
ENDRIN				U						U		
GAMMA-CHLORDANE				U					180	=		
HEPTACHLOR EPOXIDE				U						U		
p,p'-DDD				U						U		
p,p'-DDE				U						U		
p,p'-DDT				U						U		
PCBs (ug/KG)												
PCB-1260 (AROCHLOR 1260)				U						R		
Volatile Organic Compounds (ug/KG)												
2-HEXANONE				U								
ACETONE			46	=								
BENZENE				U								
CARBON DISULFIDE			2	J								
CHLOROFORM			0.8	J								
ETHYLBENZENE			0.8	J								
M,P-XYLENE			2	J								
METHYL ETHYL KETONE (2-BUTANONE)				U								
METHYLENE CHLORIDE				U								
O-XYLENE			0.5	J								
TOLUENE			4	J								
TRICHLOROETHYLENE (TCE)				U								
XYLENES, TOTAL			3	J								
Semivolatile Organic Compounds (ug/KG)												
ANTHRACENE				U						R		
BENZO(a)ANTHRACENE				U						R		
BENZO(a)PYRENE				U						R		
BENZO(b)FLUORANTHENE				U						R		
BENZO(g,h,i)PERYLENE				U						R		
BENZO(k)FLUORANTHENE				U						R		
BENZYL BUTYL PHTHALATE				U						R		
bis(2-ETHYLHEXYL) PHTHALATE				U						R		
CARBAZOLE				U						R		
CHRYSENE				U						R		
DIBENZ(a,h)ANTHRACENE				U						R		
DI-n-BUTYL PHTHALATE				U						R		
DI-n-OCTYLPHTHALATE				U						R		
FLUORANTHENE				U						R		
INDENO(1,2,3-c,d)PYRENE				U						R		
PHENANTHRENE				U						R		
PYRENE				U						R		

ParameterName	BDSB097 Result	Q	BDSB101 Result	Q	BDSB104 Result	Q	BDSB107 Result	Q	BDSB108 Result	Q	BDSB109 Result	Q
Dioxins (ng/KG)												
TEQ OF 2,3,7,8-TCDD	68.6	=										
Inorganics (mg/KG)												
ALUMINUM	6000	=	5500	=	3700	=			2800	=	2100	=
ANTIMONY	22	J	9.8	J		UJ				UJ		UJ
ARSENIC	21	=	8	=	1.5	J			1.3	J	1.6	J
BARIUM	740	=	380	=	22	J			23	J	20	J
BERYLLIUM	0.17	J	0.17	J	0.16	J			0.16	J	0.12	J
CADMIUM	8.7	=	6.5	=	0.16	J			0.59	J	0.28	J
CALCIUM	14000	=	11000	=	34000	=			12000	=	2600	=
CHROMIUM TOTAL	81	=	39	=	7.3	=			12	J	6.2	=
COBALT	11	J	4.3	J	0.72	J			0.7	J	0.49	J
COPPER	460	J	320	J	10	J			21	J	13	=
IRON	110000	=	41000	=	3700	=			4500	=	4700	=
LEAD	2600	J	860	J	37	J	60.7	=	73	=	85	J
MAGNESIUM	910	J	1000	J	490	J			270	J	150	J
MANGANESE	760	=	380	=	29	=			62	=	57	=
NICKEL	54	J	21	J	1.9	J			5.5	J	2.6	J
POTASSIUM	280	J	300	J	160	J			140	J	130	J
SILVER	5.1	=	1.4	J		U				U		U
SODIUM	300	J	320	J	85	J			380	J		U
VANADIUM	17	=	22	=	9	J			8.1	J	7	J
ZINC	2000	=	5100	=	48	=			140	=	100	=
MERCURY	1.3	=	0.85	=	0.07	J			0.12	=	0.097	J
THALLIUM												
CYANIDE	1.1	J	0.39	J	0.06	J				U	1.2	J
Pesticides (ug/KG)												
ALDRIN		U										
ALPHA-CHLORDANE		U										
DIELDRIN		U										
ENDRIN		U										
GAMMA-CHLORDANE		U										
HEPTACHLOR EPOXIDE		U										
p,p'-DDD		U										
p,p'-DDE		R										
p,p'-DDT		R										
PCBs (ug/KG)												
PCB-1260 (AROCHLOR 1260)		R										
Volatile Organic Compounds (ug/KG)												
2-HEXANONE		U										
ACETONE	69	=										
BENZENE		U										
CARBON DISULFIDE		U										
CHLOROFORM		U										
ETHYLBENZENE	0.8	J										
M,P-XYLENE	2	J										
METHYL ETHYL KETONE (2-BUTANONE)	6	J										
METHYLENE CHLORIDE		U										
O-XYLENE	0.6	J										
TOLUENE	3	J										
TRICHLOROETHYLENE (TCE)		U										
XYLENES, TOTAL	3	J										
Semivolatile Organic Compounds (ug/KG)												
ANTHRACENE		U										
BENZO(a)ANTHRACENE	120	J										
BENZO(a)PYRENE	120	J										
BENZO(b)FLUORANTHENE		U										
BENZO(g,h,i)PERYLENE	98	J										
BENZO(k)FLUORANTHENE		U										
BENZYL BUTYL PHTHALATE		U										
bis(2-ETHYLHEXYL) PHTHALATE		U										
CARBAZOLE		U										
CHRYSENE	120	J										
DIBENZ(a,h)ANTHRACENE		U										
DI-n-BUTYL PHTHALATE		U										
DI-n-OCTYLPHTHALATE		U										
FLUORANTHENE	280	J										
INDENO(1,2,3-c,d)PYRENE		U										
PHENANTHRENE	130	J										
PYRENE	160	J										

ParameterName	BDSB110 Result	Q	BDSB113 Result	Q	BDSB116 Result	Q	BDSB124 Result	Q	BDSB127 Result	Q
Dioxins (ng/KG)										
TEQ OF 2,3,7,8-TCDD			0.33	=						
Inorganics (mg/KG)										
ALUMINUM	1400	=	1400	=	2400	J	2300	=	2100	=
ANTIMONY		UJ		UJ		UJ	1.2	J	1	J
ARSENIC	0.83	J		U	1.5	J	4.7	=	2.2	J
BARIUM	89	J	5.2	J	19	J	81	=	65	=
BERYLLIUM		J		U	0.077	J	0.12	J		U
CADMIUM	0.72	J		U	0.28	J	1.4	=	0.78	J
CALCIUM	1300	=	1100	=	130000	=	6800	=	3000	=
CHROMIUM TOTAL	8	J	1.9	J	7.7	=	20	=	11	=
COBALT	0.5	J		U	0.42	J	2.6	J	0.99	J
COPPER	19	J	1.6	J	12	=	280	=	31	=
IRON	2500	=	800	=	3800	=	23000	=	7600	=
LEAD	96	=	10	J	33	=	170	=	130	=
MAGNESIUM	98	J	67	J	1000	J	230	J	140	J
MANGANESE	88	=	33	=	35	=	160	J	85	J
NICKEL	2.1	J		U	1.9	J	18	=	4.3	J
POTASSIUM	66	J	59	J	140	J	99	J	91	J
SILVER		U		U		U	0.39	J	0.31	J
SODIUM		U		U		U		U		U
VANADIUM	3.6	J	2.3	J	8	J	6	J	5.7	J
ZINC	220	=	22	=	41	=	600	=	170	=
MERCURY	0.064	J	0.05	J	0.026	J	0.19	=	0.12	=
THALLIUM										
CYANIDE	0.8	J	0.69	J	0.83	J	0.15	J	0.25	J
Pesticides (ug/KG)										
ALDRIN				UJ		U				R
ALPHA-CHLORDANE				UJ		U				R
DIELDRIN				UJ		U				R
ENDRIN				UJ		U				R
GAMMA-CHLORDANE				UJ		U				R
HEPTACHLOR EPOXIDE				UJ		U				R
p,p'-DDD				UJ		U				R
p,p'-DDE				UJ		U				R
p,p'-DDT				UJ		UJ				R
PCBs (ug/KG)										
PCB-1260 (AROCHLOR 1260)				R	8.5	J			6.6	J
Volatile Organic Compounds (ug/KG)										
2-HEXANONE						U			8	J
ACETONE						U				U
BENZENE						U				U
CARBON DISULFIDE						U				U
CHLOROFORM						U				U
ETHYLBENZENE						U			0.2	J
M,P-XYLENE						U			0.6	J
METHYL ETHYL KETONE (2-BUTANONE)						U				U
METHYLENE CHLORIDE						U				U
O-XYLENE						U				U
TOLUENE						U			2	J
TRICHLOROETHYLENE (TCE)						U				U
XYLENES, TOTAL						U			0.6	J
Semivolatile Organic Compounds (ug/KG)										
ANTHRACENE				U		U				U
BENZO(a)ANTHRACENE				U		U				U
BENZO(a)PYRENE				U		U				U
BENZO(b)FLUORANTHENE				U		U				U
BENZO(g,h,i)PERYLENE				U		U				U
BENZO(k)FLUORANTHENE				U		U				U
BENZYL BUTYL PHTHALATE				U		U				U
bis(2-ETHYLHEXYL) PHTHALATE				U		U				U
CARBAZOLE				U		U				U
CHRYSENE				U		U				U
DIBENZ(a,h)ANTHRACENE				U		U				U
DI-n-BUTYL PHTHALATE				U		U				U
DI-n-OCTYLPHTHALATE				U		U				U
FLUORANTHENE				U		U				U
INDENO(1,2,3-c,d)PYRENE				U		U				U
PHENANTHRENE				U		U				U
PYRENE				U		U				U

=, Unqualified
U, Undetected
J, Estimated value
R, Data was rejected
Samples shown in yellow exceed screening value
Samples shown in orange exceed refinement value.
Screened COPEC are blacked out.

3 12 0212

Table 2-4
Surface Soil Sample Results and Selection of PCOPEC and COPEC
Browns Dump Superfund Site
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ParameterName	In	BDSB130		BDSB134		BDSB135		BDSB142		BDSB145		BDSB147		BDSB148		BDSB149		BDSB151		BDSB152		BDSB156		BDSB157		BDSB160		BDSB161		BDSB163		BDSB166		BDSB167		BDSB170		BDSB177		BDSB178		BDSB179		BDSB180		BDSB181	
		Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
Dioxins (ng/KG)																																														
TEQ OF 2,3,7,8-TCDD																				39.6	=			1.5	J																						
Inorganics (mg/KG)																																														
ALUMINUM		7800	J	2800	=	2900	=	1900	=	2000	=	3800	=	2600	=	2000	=	2300	=	2300	=	1500	=	1200	=	1500	=	1400	=	1800	=	2500	=	2300	=	1800	=	1400	J	3400	=	990	=	920	J	1100	J
ANTIMONY		3.4	J	5.5	J	1.9	J		UJ		UJ		UJ		UJ		UJ		UJ	0.58	J		UJ		U		UJ		U		UJ		UJ		UJ		UJ		UJ		UJ	0.93	J		UJ
ARSENIC		3.5	=	5.7	=	3.6	=	1.2	J	0.52	J	1.4	J	1.3	J	1.9	J	1.3	J	8.2	=	0.52	J	0.86	J	0.47	J	0.71	J	0.89	J	2.6	=	0.52	J	2.8	=	0.73	J	1.4	J		U	2.5	=	1	J
BARIUM		349	=	150	=	200	=	15	J	18	J	26	J	30	J	41	J	14	J	29	J	10	J	15	J	26	J	29	J	18	J	17	J	20	J	38	J	22	J	28	J	18	J	110	=	34	J
BERYLLIUM		0.083	J	0.081	J	0.081	J	0.11	J		U	0.13	J	0.11	J	0.072	J	0.078	J	0.23	J		U	0.089	J	0.1	J		U	0.067	J	0.15	J	0.12	J		U		U		U		U		U		U
CADMIUM		5.1	=	2	=	2.4	=	0.16	J	0.2	J	0.37	J	0.43	J	0.84	J	0.23	J	0.23	J	0.23	J	0.12	J	0.16	J	0.44	J	0.3	J	0.21	J	0.16	J	0.48	J	0.49	J	0.31	J	1.2	=	1.5	=	0.6	J
CALCIUM		17000	=	2300	=	4600	=	18000	=	15000	=	2400	=	5200	=	6900	=	4700	=	1400	J	5000	=	9200	=	8200	=	2800	J	4900	=	5600	=	6100	=	2000	=	1600	=	1300	=	1000	J	8700	=	3000	=
CHROMIUM, TOTAL		27	=	18	=	25	=	4.6	=	4.8	=	8.4	=	8.1	=	6.3	=	7.8	=	6.5	J	3.4	=	3.1	J	3.8	=	4.7	J	4.7	=	6	=	6.4	=	5.2	=	3.3	=	6	=	3.2	=	9.2	=	8.6	=
COBALT		2	J	2.7	J	2.5	J	0.34	J	0.3	J	0.79	J	0.69	J	0.72	J	0.32	J	0.68	J	0.26	J	0.36	J	0.27	J	0.37	J	0.35	J	0.67	J	0.57	J	0.7	J	0.44	J	0.51	J	0.41	J	1.5	J	0.58	J
COPPER		70	=	110	=	120	J	9.4	=	9.4	=	14	=	24	=	37	=	11	=	54	J	52	J	8.7	J	6.6	=	14	=	9.3	=	11	=	9.6	=	24	=	18	=	7.2	=	26	=	43	=	40	=
IRON		10000	=	25000	=	18000	=	2400	=	2500	=	6400	=	5100	=	4600	=	2800	=	8300	=	1900	=	2000	=	1800	=	2800	=	2800	=	2200	=	2000	=	3000	=	2400	=	3100	=	3500	=	11000	=	2200	=
LEAD		340	=	740	=	320	J	45	J	46	J	50	J	81	J	60	J	24	J	73	=	47	J	48	=	49	J	63	=	58	J	42	J	40	J	79	J	81	=	99	J	30	J	160	=	100	=
MAGNESIUM		960	J	320	J	260	J	400	J	200	J	350	J	260	J	230	J	1700	=	120	J	120	J	180	J	670	J	100	J	260	J	370	J	440	J	130	J	140	J	170	J	76	J	220	J	220	J
MANGANESE		180	=	220	=	230	=	21	=	27	=	100	=	70	=	62	=	37	=	80	J	15	=	21	J	42	=	35	J	48	=	33	=	38	=	34	=	32	=	30	=	32	=	62	=	37	=
NICKEL		9.6	J	13	=	11	J		U		U	3.3	J	3.7	J	3.8	J		U	4.3	J	1.6	J	2.3	J	1.5	J	2	J	2.1	J	2.2	J	3.6	J	2.3	J	9.2	=	2.1	J	2.3	J	6.3	J	6.9	J
POTASSIUM		340	J	130	J	100	J	99	J	120	J	330	J	200	J	130	J	96	J	100	J	70	J	44	J	91	J	62	J	100	J	240	J	150	J	120	J	92	J	99	J	68	J	91	J	72	J
SILVER		0.74	J	1.5	J	0.84	J		U		U		U		U		U		U		UJ		UJ		UJ		U		UJ		U		UJ		U		U		UJ		UJ		U		U
SODIUM			U		U		UJ		U		U		U		U		U		U		U		U		U		U		UJ		U		UJ		U		U		U		U		U	
VANADIUM		12	J	8.9	J	7.7	J	4.6	J	5.2	J	10	J	8.8	J	6.1	J	6.2	J	14	=	4.3	J	3.9	J	4.3	J	4.1	J	4.7	J	6.1	J	4.4	J	5.4	J	5.7	J	8.1	J	2.2	J	5	J	7	J
ZINC		950	=	550	=	500	=	45	=	46	=	120	=	120	=	200	=	71	=	130	=	91	=	82	=	58	=	93	=	94	=	89	=	54	=	250	=	180	=	79	=	110	=	380	=	150	=
MERCURY		0.19	=	0.58	=	0.45	=	0.034	J	0.035	J	0.063	J	0.065	J	0.12	J	0.044	J	0.075	J	0.024	J	0.032	J	0.065	J	0.073	J	0.046	J	0.058	J	0.038	J	0.051	J	0.07	J	0.078	J	0.026	J	0.15	=	0.09	J
THALLIUM																																														
CYANIDE		2.3	J	0.37	J	0.54	J		UJ		UJ	1.4	J	1.1	J	1.1	J	0.63	J		U		R		U	0.77	J		U	1.2	J	2.4	J	1.6	J	0.71	J	1.9	J	1.2	J	0.72	J	2.3	J	1.7	J
Pesticides (ug/KG)																																														
ALDRIN			U		U																			UJ																						
ALPHA-CHLORDANE			U		U																			UJ																						
DIELDRIN			U		U																			UJ																						
ENDRIN			U		U																			UJ																						
GAMMA-CHLORDANE			U		U																			0.46	J																						
HEPTACHLOR EPOXIDE			U		U																			UJ																						
p,p'-DDD			U		U																			UJ																						
p,p'-DDE		29	J		U																			UJ																						
p,p'-DDT		20	J		U																			UJ																						
PCBs (ug/KG)																																														
PCB-1260 (AROCHLOR 1260)		66	J	46	=																			UJ																						
Volatile Organic Compounds (ug/KG)																																														
2-HEXANONE			U		U																																									
ACETONE		61	=	23	J																																									
BENZENE		4	J		U																																									
CARBON DISULFIDE			U	2	J																																									
CHLOROFORM			U		U																																									
ETHYLBENZENE		0.3	J		U																																									
M,P-XYLENE		0.7	J		U																																									
METHYL ETHYL KETONE (2-BUTANONE)			U		U																																									
METHYLENE CHLORIDE			U		U																																									
O-XYLENE			U		U																																									
TOLUENE		2	J	0.3	J																																									
TRICHLOROETHYLENE (TCE)			U		U																																									
XYLENES, TOTAL		0.7	J		U																																									
Semivolatile Organic Compounds (ug/KG)																																														
ANTHRACENE			U		U																			U																						
BENZO(a)ANTHRACENE			U		U																			58	J																						
BENZO(a)PYRENE			U		U																			55	J																						
BENZO(b)FLUORANTHENE			U		U																			55	J																						
BENZO(g,h,i)PERYLENE			U		U																			81	J																						
BENZO(k)FLUORANTHENE			U		U																			55	J																						
BENZYL BUTYL PHTHALATE			U		U																			54	J																						
bis(2-ETHYLHEXYL) PHTHALATE		790	=		U																				U																						
CARBAZOLE			U		U																			25	J																						
CHRYSENE			U		U																			63	J																						
DIBENZ(a,h)ANTHRACENE			U		U																			67	J																						
DI-n-BUTYL PHTHALATE			U		U																				U																						
DI-n-OCTYLPHTHALATE			U		U																			130	J																						
FLUORANTHENE			U		U																				U																						
INDENO(1,2,3-c,d)PYRENE			U		U																				U																						
PHENANTHRENE			U		U																				U																						
PYRENE			U		U																				U																						

-, Unqualified
U, Undetected
J, Estimated value
R, Data was rejected
Samples shown in yellow exceed screening value
Samples shown in orange exceed refinement value
Screened COPEC are blacked out

Table 2-4
Surface Soil Sample Results and Selection of PCOPEC and COPEC
Browns Dump Superfund Site
Page 4 of 5

ParameterName	BDSB182		BDSB185		BDSB186		BDSB187		BDSB189		BDSB192		BDSB304		BDSB307		BDSB310		BDSB311		BDSB315		BDSB317		BDSB323		BDSB333		BDSB339		BDSB340		BDSB345		BDSB346		BDSB347		BDSB418		AOC Samples			
	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Total Samples	Total Detections	Minimum Detected	Average Detected
Dioxins (ng/KG)																																											
TEQ OF 2,3,7,8-TCDD																													2.2	=							1	=			10	10	0.33	14.7
Inorganics (mg/KG)																																											
ALUMINUM	1900	J	1400	J	1700	J	1500	=	1700	J	1300	J	1500	=	2800	=	1700	=	2700	=	1900	=	1500	=	2000	=	1800	=	1700	=	2200	=	1400	=	2100	=	2300	=	580	=	86	86	580	2648.5
ANTIMONY	0.93	J		UJ	0.58	J		UJ	0.53	J		UJ		UJ		UJ		U		U		UJ		UJ		UJ		UJ		U		U		UJ		UJ		UJ	86	26	0.52	7.0
ARSENIC	2.5	=	0.63	J	1.2	J		U	1.5	J	0.87	J	1.2	J	4.6	=	0.47	J	1.2	J	0.52	J	0.75	J		U		U	1.1	J	0.9	J	0.72	J	1.2	J		U		U	86	76	0.47	2.7
BARIUM	97	=	14	J	43	=	11	J	140	=	27	J	40	J	95	J	15	J	32	J	77	J	24	J	15	J	13	J	12	J	22	J	9.6	J	12	J	33	J	11	J	86	86	3.3	82.7
BERYLLIUM	0.1	J		U	0.066	J		U		U	0.11	J	0.1	J	0.16	J		U		U	0.074	J	0.062	J	0.089	J		U	0.076	J	0.14	J	0.063	J	0.14	J		U		U	55	52	0.062	0.1
CADMIUM	1.9	=	0.12	J	0.69	J	0.095	J	0.86	J	0.41	J	0.55	J	0.57	J	0.15	J	0.6	J	0.17	J	0.6	J	0.14	J	0.16	J		U	0.14	J	0.12	J	0.11	J		U	0.18	J	86	80	0.095	1.0
CALCIUM	11000	=	75000	=	8400	=	4200	=	2500	=	12000	=	4300	=	2200	=	3600	=	6300	=	10000	=	37000	=	10000	=	2700	=	3700	=	3900	=	1300	J	36000	J	2900	J	7300	J	86	86	890	10372.0
CHROMIUM, TOTAL	7.5	=	3.7	=	7.6	=	3.1	=	31	=	3.9	=	8.2	J	9.5	J	3.4	=	6.3	=	4.2	J	5.2	J	4.3	=	5.1	J	5.3	J	5.3	J	8.3	J	4.8	J	4.4	=	2.4	=	86	86	1.3	10.3
COBALT	0.79	J	0.24	J	0.44	J	0.2	J	0.63	J	0.29	J	0.7	J	1.8	J		U	0.46	J	0.33	J	0.45	J		U	0.41	J	0.3	J	0.42	J	0.29	J	0.55	J		U		U	86	77	0.2	1.1
COPPER	110	=	7.4	=	21	=	8.1	=	40	=	13	=	24	J	27	J	7	=	63	=	9.1	J	19	J	12	=	11	J	5.8	J	13	J	4.2	J	3.8	J	2	J	5.7	J	86	86	1.6	43.7
IRON	3700	=	1100	=	3100	=	1500	=	2600	=	3300	=	4200	=	13000	=	1400	=	2500	=	1300	=	2400	=	1600	=	1700	=	1800	=	2300	=	1700	=	1900	=	260	=	880	=	86	86	260	6718.8
LEAD	240	=	42	=	170	=	28	J	580	=	190	=	97	=	150	=	30	=	75	=	43	=	98	=	51	J	28	=	21	=	32	=	21	=	18	=	6.6	=	68	=	89	89	5.4	677.4
MAGNESIUM	510	J	260	J	260	J	160	J	230	J	400	J	180	J	210	J	130	J	210	J	290	J	530	J	290	J	380	J	200	J	240	J	120	J	390	J	71	J	210	J	86	86	67	552.2
MANGANESE	53	=	23	=	55	=	18	=	120	=	60	=	58	J	370	=	65	J	27	J	24	J	42	J	21	=	54	J	13	J	14	J	28	J	18	J	4	=	21	=	86	86	4	85.7
NICKEL	5.2	J	1.1	J	3.3	J		U	3.1	J	2.6	J	4	J	5.5	J	1.1	J	3.3	J	1.4	J	3.2	J		U	1.8	J	2.4	J	1.7	J	1.1	J	1.3	J	0.52	J	1.8	J	86	79	0.52	5.5
POTASSIUM	87	J	64	J	75	J	75	J	170	J	130	J	110	J	140	J	69	J	99	J	78	J	81	J	62	J	78	J	99	J	120	J	58	J	110	J	58	J	36	J	86	86	21	174.0
SILVER	0.2	J		U		U		U		U		U		U		U		U		U		U		U		U		U		U		U		U		U		U	86	17	0.2	1.0
SODIUM		U		U		U		U		U		UJ		U		U		U		UJ		U		UJ		UJ		U		UJ		U	76	J		U		U	86	10	60	304.2
VANADIUM	6.2	J	3.3	J	5.3	J	3.2	J	6.2	J	5.2	J	4.5	J	10	J	4.2	J	5.8	J	4.9	J	5	J	4.1	J	3.5	J	4.1	J	4.9	J	3.8	J	7.9	J	2.4	J	3.8	J	86	86	1.8	7.6
ZINC	350	=	68	=	190	=	89	=	340	=	93	=	170	=	280	=	61	=	180	=	77	=	140	=	120	=	49	=	27	=	54	=	33	=	17	=	5.8	=	89	=	86	86	5.8	334.3
MERCURY	0.19	=	0.053	J	0.2	=	0.036	J	0.17	J	0.067	J	0.12	=	0.1	=		U	0.004	J	0.052	J	0.036	J	0.029	J	0.069	J	0.028	J	0.087	J	0.11	=	0.013	J	0.039	J	0.022	J	86	84	0.004	0.3
THALLIUM																																									1	1	0.38	0.4
CYANIDE	1.2	J	1.6	J	1.7	J	0.56	J	1.8	J	1.9	J		U		U		U		U		U		U	0.97	J		U		U		U		U		U		U	86	54	0.06	0.9
Pesticides (ug/KG)																																											
ALDRIN		U																												U						R				19	1	160	160.0
ALPHA-CHLORDANE	79	=																												U						R				19	2	79	139.5
DIELDRIN		U																												U						R				19	1	100	100.0
ENDRIN	41	J																												U						R				19	1	41	41.0
GAMMA-CHLORDANE	84	=																												R						R				19	4	0.46	178.6
HEPTACHLOR EPOXIDE	7.3	J																												R						R				19	1	7.3	7.3
p,p'-DDD	44	J																												U						R				19	1	44	44.0
p,p'-DDE	120	=																												U						R				19	3	26	175.3
p,p'-DDT	190	=																												U						R				19	4	20	330.0
PCBs (ug/KG)																																											
PCB-1260 (AROCHLOR 1260)	260	=																												R						R				19	7	6.6	61.6
Volatile Organic Compounds (ug/KG)																																											
2-HEXANONE																																									11	1	8	8.0
ACETONE																																									11	7	23	51.3
BENZENE																																									11	4	0.6	1.8
CARBON DISULFIDE																																									11	4	2	6.8
CHLOROFORM																																										11	1	0.8	0.8
ETHYLBENZENE																																									11	6	0.2	0.4
M,P XYLENE																																										11	7	0.5	1.0
METHYL ETHYL KETONE (2-BUTANONE)																																										11	3	4	9.3
METHYLENE CHLORIDE																																										11	1	5	5.0
O-XYLENE																																										11	2	0.5	0.6
TOLUENE																																										11	7	0.3	2.0
TRICHLOROETHYLENE (TCE)																																										11	1	0.7	0.7
XYLENES, TOTAL																																										11	5	0.6	1.6
Semivolatile Organic Compounds (ug/KG)																																											
ANTHRACENE		U																												U						U				19	3	120	160.0
BENZO(a)ANTHRACENE	250	J																											88	J						U				19	10	58	246.6
BENZO(a)PYRENE	250	J																											99	J						U				19	10	55	252.4
BENZO(b)FLUORANTHENE	240	J																											100	J						U				19	9	55	282.8
BENZO(g,h,i)PERYLENE	160	J																												U						U				19	8	81	191.8
BENZO(k)FLUORANTHENE	240	J																											98	J						U				19	9	55	237.0
BENZYL BUTYL PHTHALATE		U																												U						U				19	1	54	54.0
bis(2-ETHYLHEXYL) PHTHALATE	320	J																												U						U				19	4	130	405.0
CARBAZOLE		U																												U						U				19	2	25	52.0
CHRYSENE	270	J																											100	J						U				19	10	83	306.3
DIBENZ(a,h)ANTHRACENE		U																												U						U				19	3	67	91.0
DI-n-BUTYL PHTHALATE		U																												U						U				19	1	40	40.0
DI-n-OCTYLPHTHALATE		U																												U						U				19	1	130	130.0
FLUORANTHENE	570	=																											190	J						U				19	9	190	520.0
INDENO(1,2,3-c,d)PYRENE		U																												U						U				19	5	90	214.0
PHENANTHRENE	190	J																												U						U				19	8	83	236.6
PYRENE	350	J																											120	J						U				19	9	120	338.9

-, Unqualified
U, Undetected
J, Estimated value
R, Data was rejected
Samples shown in yellow exceed screening value
Samples shown in orange exceed refinement value
Screened COPEC are blacked out

3 12 0214

10/16/2002

Table 2-4
Surface Soil Sample Results and Selection of PCOPEC and COPEC
Browns Dump Superfund Site
Page 5 of 5

Parameter Name		Screening for PCOPEC Selection				Refinement for Direct Exposure COPEC Selection				
	Maximum Detected	Approved Screening Value	Total Detections > Screening Value	AOC Screening HQ Based on Maximum	Selected as PCOPC?	Approved Refinement Value	Total Detections > Refinement Value	AOC Refinement HQ Based on Maximum	Selected as COPC?	Rationale for selection as COPEC
Dioxins (ng/KG)										
TEQ OF 2,3,7,8-TCDD	68 6	0 199	10	344 72	Yes	500000	0	0 0001	No	HQ was below 1
Inorganics (mg/KG)										
ALUMINUM	27000	50	86	540 00	Yes	600	85	***45 0000***	Yes	HQ greater than 1
ANTIMONY	63	3 5	9	18 00	Yes	5	9	***12 6000***	Yes	HQ greater than 1
ARSENIC	21	10	4	2 10	Yes	60	0	0 3500	No	HQ was below 1
BARIUM	810	165	9	4 91	Yes	500	4	***1 6200***	No	Low magnitude of exceedance
BERYLLIUM	0 68	1 1	0	0 62	No					
CADMIUM	8 7	1 6	13	5 44	Yes	20	0	0 4350	No	HQ was below 1
CALCIUM	130000	-	-	-	Yes	-	-	-	No	Essential nutrient
CHROMIUM, TOTAL	81	0 4	86	202 50	Yes	32	3	***2 5313***	No	Low magnitude of exceedance
COBALT	11	70	0	0 55	No					
COPPER	460	40	22	11 50	Yes	61	15	***7 5410***	Yes	HQ greater than 1
IRON	110000	200	86	550 00	Yes	200	86	***550 0000***	Yes	HQ greater than 1
LEAD	*43000*	50	58	860 00	Yes	500	10	***86 0000***	Yes	*HQ greater than 1*
MAGNESIUM	6490	-	-	-	Yes	-	-	-	No	Essential nutrient
MANGANESE	760	100	18	7 60	Yes	500	1	***1 5200***	No	Low magnitude of exceedance
NICKEL	54	30	1	1 80	Yes	90	0	0 6000	No	HQ was below 1
POTASSIUM	2500	-	-	-	Yes	-	-	-	No	Essential nutrient
SILVER	5 1	2	1	2 55	Yes	10	0	0 5100	No	HQ was below 1
SODIUM	1100	-	-	-	Yes	-	-	-	No	Essential nutrient
VANADIUM	85	2	85	42 50	Yes	130	0	0 6538	No	HQ was below 1
ZINC	5200	50	70	104 00	Yes	200	24	***26 0000***	Yes	HQ greater than 1
MERCURY	15	0 1	27	150 00	Yes	0 3	7	***50 0000***	Yes	HQ greater than 1
THALLIUM	0 38	1	1	0 38	No					
CYANIDE	2 4	0 9	24	2 67	Yes	5	0	0 4800	No	HQ was below 1
Pesticides (ug/KG)										
ALDRIN	160	2 5	1	64 00	Yes	2 5	1	***64 0000***	No	Low frequency of occurrence
ALPHA-CHLORDANE	200	100	1	2 00	Yes	100	1	***2 0000***	No	Low frequency of occurrence/magnitude of exceedance
DIELDRIN	100	0 5	1	200 00	Yes	0 5	1	***200 0000***	No	Low frequency of occurrence
ENDRIN	41	100	0	0 41	No					
GAMMA-CHLORDANE	460	100	2	4 60	Yes	100	2	***4 6000***	No	Low frequency of occurrence/magnitude of exceedance
HEPTACHLOR EPOXIDE	2 3	100	0	0 07	*No*					
p,p'-DDD	44	2 5	1	17 60	Yes	700	0	0 0629	No	HQ was below 1
p,p'-DDE	380	2 5	3	152 00	Yes	700	0	0 5429	No	HQ was below 1
p,p'-DDT	1000	2 5	4	400 00	Yes	17 5	4	***57 1429***	No	Low Toxicity
PCBs (ug/KG)										
PCB-1260 (AROCHLOR 1260)	260	20	4	13 00	Yes	1300	0	0 2000	No	HQ was below 1
Volatile Organic Compounds (ug/KG)										
2-HEXANONE	9	12600	0	0 00	No					
ACETONE	68	2500	0	0 03	No					
BENZENE	4	50	0	0 08	No					
CARBON DISULFIDE	14	94 12	0	0 15	No					
CHLOROFORM	0 8	1	0	0 80	No					
ETHYLBENZENE	0 8	50	0	0 02	No					
M P-XYLENE	2	50	0	0 04	No					
METHYL ETHYL KETONE (2-BUTANONE)	18	89600	0	0 00	No					
METHYLENE CHLORIDE	5	4050	0	0 00	No					
O-XYLENE	0 6	50	0	0 01	No					
TOLUENE	4	50	0	0 08	No					
TRICHLOROETHYLENE (TCE)	0 7	1	0	0 70	No					
XYLENES, TOTAL	3	50	0	0 06	No					
Semivolatile Organic Compounds (ug/KG)										
ANTHRACENE	190	100	3	1 90	Yes	5000	0	0 0380	No	HQ was below 1
BENZO(a)ANTHRACENE	590	5210	0	0 11	No					
BENZO(a)PYRENE	640	100	8	6 40	Yes	5000	0	0 1280	No	HQ was below 1
BENZO(b)FLUORANTHENE	700	59800	0	0 01	No					
BENZO(g,h,i)PERYLENE	390	119000	0	0 00	No					
BENZO(k)FLUORANTHENE	570	148000	0	0 00	No					
BENZYL BUTYL PHTHALATE	54	238 89	0	0 23	No					
bis(2-ETHYLHEXYL) PHTHALATE	790	925 94	0	0 85	No					
CARBAZOLE	79	-	-	-	Yes	5000	0	0 0158	No	HQ was below 1
CHRYSENE	660	4730	0	0 14	No					
DIBENZ(a,h)ANTHRACENE	130	18400	0	0 01	No					
DI-n-BUTYL PHTHALATE	40	200000	0	0 00	No					
DI-n-OCTYLPHTHALATE	130	709000	0	0 00	No					
FLUORANTHENE	1100	100	9	11 00	Yes	5000	0	0 2200	No	HQ was below 1
INDENO(1,2,3-c,d)PYRENE	360	109000	0	0 00	No					
PHENANTHRENE	800	100	7	8 00	Yes	5000	0	0 1200	No	HQ was below 1
PYRENE	660	100	9	6 60	Yes	5000	0	0 1320	No	HQ was below 1

Notes

-, Unqualified
U, Undetected
J Estimated value
R, Data was rejected
Samples shown in yellow exceed screening value
Samples shown in orange exceed refinement value
Screened COPEC are blacked out.

3 12 0215

Table 2-8
Sediment Sample Results and Selection of PCOPEC and COPEC
Browns Dump Superfund Site

Parameter Name	Upgradient (Background) Samples: BKBDSW001 Result	Q	BKBDSW002 Result	Q	BKBDSW003 Result	Q	BKBDSW004 Result	Q	BKBDSW005 Result	Q	Samples Collected at or Downgradient of Site: BDSW001 Result	Q	BDSW002 Result	Q	BDSW003 Result	Q	BDSW004 Result	Q	BDSW005 Result	Q	BDSW006 Result	Q	BDSW007 Result	Q	BDSW008 Result	Q
Dioxins (ng/KG)																										
TEQ OF 2,3,7,8-TCDD									3.381	J					0.015	J					0.79	J				
Inorganics (mg/KG)																										
ALUMINUM	900	=	280	=	1400	=	1800	=	930	=	410	=	320	J	210	J	280	J	500	J	640	J	470	=	480	=
ANTIMONY		UJ		UJ		UJ		UJ		UJ		UJ		U		U		U		U		U		UJ	1.2	J
ARSENIC		U		U	3.3	=	2.7	J	3.9	=		U		U		U		U	1.3	J	1.1	J	3	=	1.1	J
BARIUM	6	J	2.6	J	18	J	27	J	13	J	5.1	J	9.4	J	2.7	J	4.9	J	9.9	J	17	J	10	J	13	J
CADMIUM		U		U	0.16	J	0.18	J		U		U		U		U		U	0.14	J	0.29	J		U	0.18	J
CALCIUM	1500	J	73	J	23000	=	47000	=	5200	=	15000	=	4500		3600	=	1800	J	7700	=	10000	=	2000	=	4300	=
CHROMIUM, TOTAL	7	J	0.84	J	13	J	97	J	11	J	3.8	J	4.3	=	3.1	=	3.2	=	5.6	=	6	=	3.5	J	5.4	J
COBALT	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		U		U		U		U	0.4	J	0.36	J		U		U
COPPER	2	J		U	5.4	J	14	=	9.5	=	2.5	J	2.3	J	1.5	J	2.1	J	6.7	J	12	=	10	=	11	=
IRON	1600	=	280	=	14000	=	9300	=	2400	=	850	=	1000	J	380	J	1100	=	3100	=	2800	=	1400	=	1500	=
LEAD	5.5	=	3.8	=	16	=	12	=	21	=	7.7	=	7	=	4.9	=	7.9	J	14	J	48	J	44	=	46	=
MAGNESIUM	130	J	29	J	770	J	1000	J	240	J	160	J	100	J	80	J	73	J	150	J	290	J	180	J	170	J
MANGANESE	7.7	J	1.2	J	77	J	740	J	15	J	7.5	J	11	=	2.8	J	5.6	=	34	=	22	=	12	=	8.7	=
NICKEL	0.87	J		U	0.96	J	7.6	J	1.9	J		U		U		U		U	0.89	J	2.3	J	0.93	J	2.4	J
POTASSIUM	69	J		U	46	J	110	J	67	J	33	J	31	J		U	29	J	79	J	56	J	41	J	35	J
VANADIUM	3.3	J	1.1	J	8.7	J	9.3	J	4.7	J	1.4	J	1.7	J	0.75	J	1	J	2	J	2.7	J	1.6	J	3	J
ZINC	27	=	7.5	=	36	=	45	=	53	=	19	=	23	=	16	=	27	=	52	=	120	=	87	=	77	=
MERCURY	0.012	J		U	0.014	J	0.015	J	0.018	J	0.008	J	0.0068	J	0.0033	J	0.0046	J	0.011	J	0.065	J	0.045	J	0.0077	J
Pesticides (ug/KG)																										
ALPHA-CHLORDANE		U		U	0.47	J	1.3	J	1.1	J	0.43	J		U		U		U	0.42	J		U	0.78	J		U
ENDRIN ALDEHYDE		U		U		U		U		U		U		U		U		U		U		U		U	0.75	J
GAMMA-CHLORDANE		U		U	0.8	J	1	J	1.3	J	0.44	J		U		U		U	1.4	J		U	1.5	J		U
p,p-DDD		U		U		U		U		U		U		U		U		U		U	0.88	J		U		U
p,p-DDE		U		U		U		U		U		U		U		U		U		U	2.1	J	0.42	J		U
p,p-DDT		UJ		U		UJ		UJ		U		UJ		U		U		U		U	5	=		U		U
PCBs (ug/KG)																										
PCB-1260 (AROCHLOR 1260)		U		U		U		U		U		U		U		U		U		U	22	J		U		U
Volatile Organic Compounds (ug/KG)																										
ACETONE									58	=						U					69	=				
METHYL ETHYL KETONE (2-BUTANONE)									24	=						U					25	=				
Semivolatile Organic Compounds (ug/KG)																										
BENZO(a)ANTHRACENE		U		U		U		U	45	J	32	J		U		U		U		U	75	J		U	39	J
BENZO(a)PYRENE		U		U		U		U	54	J	44	J	62	J	43	J		U		U	80	J		U		U
BENZO(b)FLUORANTHENE		U		U		U		U	72	J	47	J	34	J		U		U	41	J	82	J		U		U
BENZO(g,h,i)PERYLENE		U		U		U		U	52	J	34	J	36	J		U		U		U	62	J		U		U
BENZO(k)FLUORANTHENE		U		U		U		U	46	J	36	J		U		U		U		U	63	J		U		U
bis(2-ETHYLHEXYL) PHTHALATE	180	J		U	92	J		U	84	J	64	J		U		U		U		U		U		U	84	J
CHRYSENE		U		U		U		U	51	J	44	J	32	J		U		U	45	J	67	J		U	53	J
DI-n-BUTYL PHTHALATE		U		U		U		U		U		U		U		U		U	43	J		U		U		U
FLUORANTHENE		U		U		U		U	51	J	46	J		U		U		U	50	J	78	J		U	58	J
PHENANTHRENE		U		U		U		U		U		U		U		U		U		U	24	J		U		U
PYRENE		U		U		U		U	85	J	65	J		U		U		U		U	180	J		U		U

Parameter Name	AOC Samples: Total Samples	Total Detections	Minimum Detected	Average Detected	Maximum Detected	Screening for PCOPEC Selection: Approved Screening Value	Total Detections > Screening Value	AOC Screening HQ Based on Maximum	Selected as PCOPC?	Refinement for Direct Exposure COPEC Selection: Approved Refinement Value	Total Detections > Refinement Value	AOC Refinement HQ Based on Maximum	Selected as COPC?	Rationale for selection as COPEC
Dioxins (ng/KG)														
TEQ OF 2,3,7,8-TCDD	3	3	0.015	0.153	0.79	2.5	0	0.12	No					
Inorganics (mg/KG)														
ALUMINUM	13	13	210	473.8	640	-	-	-	Yes	600 (a)	1	1.07	No	HQ was below 1
ANTIMONY	13	1	1.2	1.2	1.2	2	0	0.60	No					
ARSENIC	13	7	1.1	1.8	3	7.24	0	0.41	No					
BARIUM	13	13	2.7	9.0	17	-	-	-	Yes	200	0	0.09	No	HQ was below 1
CADMIUM	13	5	0.14	0.2	0.29	0.676	0	0.43	No					
CALCIUM	13	13	1900	6125.0	15000		-	-	Yes	-	-	-	No	Essential nutrient
CHROMIUM, TOTAL	13	13	3.1	4.4	6	52.3	0	0.11	No					
COBALT	13	6	0.36	0.4	0.4	50	0	0.01	No					
COPPER	13	12	1.5	6.0	12	[illegible]	0	[illegible]	No					
IRON	13	13	380	1518.3	3100	-	-	-	Yes	20000	0	0.16	No	HQ was below 1
LEAD	13	13	4.9	21.4	46	30.2	3	1.52	Yes	91.3	0	0.50	No	HQ was below 1
MAGNESIUM	13	13	73	150.4	290	-	-		Yes	-	-	-	No	Essential nutrient
MANGANESE	13	13	2.8	13.0	34	-	-	-	Yes	460	0	0.07	No	HQ was below 1
NICKEL	13	8	0.89	1.6	2.4	15.9	0	0.15	No					
POTASSIUM	13	11	29	43.4	79		-	-	Yes	-	-	-	No	Essential nutrient
VANADIUM	13	13	0.75	1.7	3	-	-	-	Yes	130	0	0.02	No	HQ was below 1
ZINC	13	13	16	50.1	120	124	0	0.97	No					
MERCURY	13	12	0.0033	0.0	0.065	0.13	0	0.47	No					
Pesticides (ug/KG)														
ALPHA-CHLORDANE	13	6	0.42	0.54	0.78	0.5	1	1.56	Yes	4.79	0	0.15	No	HQ was below 1
ENDRIN ALDEHYDE	13	1	0.75	0.75	0.75	3200	0	0.00	No					
GAMMA-CHLORDANE	13	6	0.44	1.11	1.5	0.5	2	3.00	Yes	4.79	0	0.31	No	HQ was below 1
p,p-DDD	13	1	0.88	0.88	0.88	1.22	0	0.72	No					
p,p-DDE	13	2	0.42	1.26	2.1	2.07	1	1.01	Yes	6.75	0	0.31	No	HQ was below 1
p,p-DDT	13	1	5	5.00	5	1.19	1	4.20	Yes	4.77	1	1.05	No	Low magnitude and frequency of exceedance
PCBs (ug/KG)														
PCB-1260 (AROCHLOR 1260)	13	1	22	22	22	34.1	0	0.65	No					
Volatile Organic Compounds (ug/KG)														
ACETONE	3	2	69	69	69	453.37	0	0.15	No					
METHYL ETHYL KETONE (2-BUTANONE)	3	2	25	25	25	136.95	0	0.18	No					
Semivolatile Organic Compounds (ug/KG)														
BENZO(a)ANTHRACENE	13	4	32	49	75	74.8	1	1.00	Yes	385	0	0.19	No	HQ was below 1
BENZO(a)PYRENE	13	5	43	57	80	88.8	0	0.90	No					
BENZO(b)FLUORANTHENE	13	5	34	50	82	10400	0	0.01	No					
BENZO(g,h,i)PERYLENE	13	4	34	51	62	170	0	0.48	No					
BENZO(k)FLUORANTHENE	13	3	36	50	63	240	0	0.26	No					
bis(2-ETHYLHEXYL) PHTHALATE	13	5	64	74	84	182	0	0.46	No					
CHRYSENE	13	6	32	51	67	108	0	0.76	No					
DI-n-BUTYL PHTHALATE	13	1	43	43	43	110.5	0	0.38	No					
FLUORANTHENE	13	5	46	56	78	113	0	0.69	No					
PHENANTHRENE	13	1	24	24	24	86.7	0	0.28	No					
PYRENE	13	3	65	135	180	153	1	1.18	Yes	875	0	0.21	No	HQ was below 1

Notes:
(a) Lower value used
= Unqualified
U Undetected
J Estimated value
R Data were rejected
Samples shown in yellow exceed screening value
Samples shown in orange exceed refinement value
Screened COPEC are blacked out

3 12 0216

8/6/2007

Table 2-8
Surface Water Sample Results and Selection of PCOPEC and COPEC
Browns Dump Superfund Site
Page 1 of 1

Parameter/Name	Upgradient (Background) Samples: BкBDSW001 Result	Q	BкBDSW002 Result	Q	BкBDSW003 Result	Q	BкBDSW004 Result	Q	BкBDSW005 Result	Q
Inorganics (mg/L)										
ALUMINUM	0.27	=	0.14	J	0.074	J	0.14	J		U
Arsenic Dissolved		U		U		J		U		U
BARIUM	0.018	J	0.06[illegible]	J	0.042	J	0.04	J	0.034	J
Barium Dissolved	0.017	J	0.044	J	0.038	J	0.079	J	0.033	J
CALCIUM	54	=	10	=	65	=	53	=	61	=
Calcium Dissolved	54	=	10	=	64	=	64	=	60	=
Chromium Dissolved		U		U		U		U		J
IRON		U	4.8	=		U		U		U
Iron Dissolved	0.08	J	1.2	=	0.053	J	0.043	J	0.15	=
MAGNESIUM	11	=	3.1	=	21	=	20	=	20	=
Magnesium Dissolved	11	=	3.2	J	20	=	20	=	20	=
MANGANESE	0.029	=	0.042	=	0.043	=	0.036	=		U
Manganese Dissolved		U	0.038	=	0.039	=	0.032	=		J
POTASSIUM	2.9	J	1.5	J	2.4	J	2.3	J	2.3	J
Potassium Dissolved	2.9	J	1.5	J	2.3	J	2.4	J	2.3	J
SODIUM	21	=	9.5	=	13	=	13	=	13	=
Sodium Dissolved	21	=	9.7	=	13	=	13	=	13	=
CYANIDE	0.0051	J		U		U		U	0.0054	J

Parameter/Name	Samples Collected at or Downgradient of Site: BDSW001 Result	Q	BDSW002 Result	Q	BDSW003 Result	Q	BDSW004 Result	Q	BDSW005 Result	Q	BDSW006 Result	Q	BDSW007 Result	Q	BDSW008 Result	Q
Inorganics (mg/L)																
ALUMINUM	0.037	J		U		U	0.042	J	0.03	J	0.033	J		U	0.043	J
Arsenic Dissolved		U		U		U	0.0035	J		U		U		U		U
BARIUM	0.043	J	0.044	J	0.045	J	0.047	J	0.05	J	0.051	J	0.041	J	0.045	J
Barium Dissolved	0.042	J	0.043	J	0.044	J	0.047	J	0.05	J	0.051	J	0.041	J	0.043	J
CALCIUM	65	=	67	=	66	=	67	=	67	=	68	=	67	=	68	=
Calcium Dissolved	66	=	68	=	67	=	69	=	69	=	71	=	65	=	68	=
Chromium Dissolved		U		U		U		U	0.007	J		U		U		U
IRON		U	0.29	=	0.42	=	0.29	=	0.33	=	0.37	=	0.37	=	0.47	=
Iron Dissolved	0.069	J		UJ		UJ		UJ		UJ		UJ		UJ		UJ
MAGNESIUM	20	=	20	=	20	=	20	=	19	=	19	=	20	=	20	=
Magnesium Dissolved	20	=	20	=	20	=	21	=	[illegible]	=	[illegible]	=	[illegible]	=	[illegible]	=
MANGANESE	0.036	=	0.033	=	0.04	=	0.021	=	0.031	=	0.034	=	0.027	=	0.025	=
Manganese Dissolved	0.032	=	0.032	=	0.038	=	0.02	=	0.031	=	0.033	=	0.019	=	0.019	=
POTASSIUM	2.4	J	2.5	J	2.6	J	2.5	J	2.6	J	2.8	J	2.5	J	2.6	J
Potassium Dissolved	2.4	J	2.5	J	2.6	J	2.5	J	2.6	J	2.9	J	2.8	J	2.6	J
SODIUM	14	=	14	=	15	=	14	=	15	=	15	=	15	=	15	
Sodium Dissolved	14	=	14	=	15	=	15	=	15	=	15	=	15	=	15	=
CYANIDE		U	0.013	=	0.0055	J		U		U		U		U	0.0049	J

Parameter/Name	AOC Samples: Total Samples	Total Detections	Minimum Detected	Average Detected	Maximum Detected	Screening for PCOPEC Selection: Approved Screening Value	Total Detections > Screening Value	AOC Screening HQ Based on Maximum	Selected as PCOPC?	Refinement for Direct Exposure COPEC Selection: Approved Refinement Value	Total Detections > Refinement Value	AOC Refinement HQ Based on Maximum	Selected as COPC?	Rationale for selection as COPEC
Inorganics (mg/L)														
ALUMINUM	13	9	0.03	0.037	0.043	0.087	0	0.49	No	[redacted]				
Arsenic Dissolved	13	1	0.0035	0.0035	0.0035	0.19	0	0.07	No	[redacted]				
BARIUM	13	13	0.041	0.04575	0.051	5	0	0.01	No	[redacted]				
Barium Dissolved	13	13	0.041	0.045125	0.051	5	0	0.01	No	[redacted]				
CALCIUM	13	13	65	66.875	68		-	-	Yes	116	0	0.59	No	HQ was below 1
Calcium Dissolved	13	13	66	68.375	71	-	-	-	Yes	116	0	0.61	No	HQ was below 1
Chromium Dissolved	13	1	0.007	0.007	0.007	0.011	0	0.18	No	[redacted]				
IRON	13	8	0.29	0.362857	0.47	1	0	0.47	No	[redacted]				
Iron Dissolved	13	6	0.069	0.069	0.069	1	0	0.07	No	[redacted]				
MAGNESIUM	13	13	19	19.75	20	-	-	-	Yes	82	0	0.24	No	HQ was below 1
Magnesium Dissolved	13	13	[illegible]	[illegible]	[illegible]				Yes	82	0	0.25	No	HQ was below 1
MANGANESE	13	12	0.021	0.03075	0.04	-		-	Yes	1.1	0	0.04	No	HQ was below 1
Manganese Dissolved	13	11	0.019	0.028	0.038	-	-		Yes	1.1	0	0.03	No	HQ was below 1
POTASSIUM	13	13	2.4	2.5625	2.8	-	-	-	Yes	53	0	0.05	No	HQ was below 1
Potassium Dissolved	13	13	2.4	2.5875	2.9	-	-	-	Yes	53	0	0.05	No	HQ was below 1
SODIUM	13	13	14	14.675	15		-	-	Yes	680	0	0.02	No	HQ was below 1
Sodium Dissolved	13	13	14	14.75	15	-	-	-	Yes	680	0	0.02	No	HQ was below 1
CYANIDE	13	5	0.0055	0.008467	0.013	0.0052	3	2.50	Yes	0.0078	1	1.67	No	Low magnitude and frequency of exceedance

Notes:
= Unqualified
U Undetected
J Estimated value
R Data was rejected
Samples shown in yellow exceed screening value
Samples shown in orange exceed refinement value
Screened COPEC are blacked out

3 12 0217

Table 2-7
Preliminary Contaminants of Potential Ecological Concern (PCOPC)
Brown's Dump Superfund Site

Surface Soil	Sediment	Surface Water
HQ > 1	*HQ > 1*	*HQ > 1*
TEQ OF 2,3,7,8-TCDD	***LEAD***	CYANIDE
ALUMINUM	***ALPHA-CHLORDANE***	
ANTIMONY	***GAMMA-CHLORDANE***	*No HQ due to Lack of Screening Values*
ARSENIC	***p,p'-DDE***	CALCIUM
BARIUM	***p,p'-DDT***	MAGNESIUM
CADMIUM	***BENZO(a)ANTHRACENE***	MANGANESE
CHROMIUM, TOTAL	***PYRENE***	POTASSIUM
COPPER		SODIUM
IRON	*No HQ due to Lack of Screening Values*	
LEAD	ALUMINUM	
MANGANESE	BARIUM	
NICKEL	CALCIUM	
SILVER	IRON	
VANADIUM	MAGNESIUM	
ZINC	MANGANESE	
MERCURY	POTASSIUM	
CYANIDE	VANADIUM	
ALDRIN		
ALPHA-CHLORDANE		
DIELDRIN		
GAMMA-CHLORDANE		
p,p'-DDD		
p,p'-DDE		
p,p'-DDT		
PCB-1260 (AROCHLOR 1260)		
ANTHRACENE		
BENZO(a)PYRENE		
CARBAZOLE		
FLUORANTHENE		
PHENANTHRENE		
PYRENE		
No HQ due to Lack of Screening Values		
CALCIUM		
MAGNESIUM		
POTASSIUM		
SODIUM		

Notes:

Contaminants indicated in bold are listed as Important Bioaccumulative Compounds by USEPA (2000) and will also be evaluated for food chain exposure to determine if they are to be retained as COPC.

Table 3-1
Contaminants of Potential Ecological Concern (COPEC) for Direct Exposure
Brown's Dump Superfund Site

Surface Soil	Sediment	Surface Water
ALUMINUM ANTIMONY COPPER IRON LEAD ZINC MERCURY	*None*	*None*

Table 6.6-2

Approved Wildlife Toxicological Reference Values for Vertebrate Receptor Species in Food Chain Models for the ERA
Brown's Dump Superfund Site

Important Bioaccumulative Compounds [1]	*Birds*					*Mammals*				
	Toxicological Reference Doses		Test Species	Endpoint	Reference	Toxicological Reference Doses		Test Species	Endpoint	Reference
	NOAEL mg/kgBW-day	LOAEL mg/kgBW-day				NOAEL mg/kgBW-day	LOAEL mg/kgBW-day			
Inorganics										
ARSENIC	2.46	7.38	Cowbird	Mortality	a	0.13	1.26	Mouse	Reproduction	a
CADMIUM	1.45	20.00	Mallard	Reproduction	a	1.00	10.00	Rat	Reproduction	a
CHROMIUM, TOTAL	1.00	5.00	Black duck	Reproduction	a	2737.00	-	Rat	Reproduction	a
COPPER	47.00	61.70	Chicks	Mortality	a	11.70	15.14	Mink	Reproduction	a
LEAD	1.13	11.30	Japanese quail	Reproduction	a	8.00	80.00	Rat	Reproduction	a
NICKEL	77.40	107.00	Mallard	Mortality	a	40.00	80.00	Rat	Reproduction	a
SILVER	1780.00	-	Mallard	Subchronic	b	-	3.75	Mouse	Neurologic	b
ZINC	14.50	131.00	Leghorn hens	Reproduction	a	160.00	320.00	Rat	Reproduction	a
MERCURY, METALLIC	0.0064	0.064	Mallard	Reproduction	a	0.03	0.16	Rat	Reproduction	a
MERCURY, METHYL	0.0064	0.064	Mallard	Reproduction	a	0.03	0.16	Rat	Reproduction	a
Pesticides										
ALDRIN	0.077	-	Barn owl	Reproduction	a (DIELD)	0.20	1.00	Rat	Reproduction	a
ALPHA-CHLORDANE	2.14	10.70	Red-winged blackbird	Mortality	a	4.60	9.20	Mouse	Reproduction	a
DIELDRIN	0.077	-	Barn owl	Reproduction	a	0.02	0.20	Rat	Reproduction	a
GAMMA-CHLORDANE	2.14	10.70	Red-winged blackbird	Mortality	a	4.60	9.20	Mouse	Reproduction	a
p,p'-DDD	0.0028	0.028	Pelican	Reproduction	a (DDT)	0.80	4.00	Rat	Reproduction	a (DDT)
p,p'-DDE	-	84.50	Coturnix quail	Mortality	b	10.00	-	Rat	Subchronic	b
p,p'-DDT	0.0028	0.028	Pelican	Reproduction	a	0.80	4.00	Rat	Reproduction	a
PCBs										
PCB-1260 (AROCHLOR 1260)	0.180	1.800	Ring-necked pheasant	Reproduction	a (PCB-1254)	0.068	0.680	Oldfield mouse	Reproduction	a (PCB-1254)
Semivolatile Organic Compounds										
ANTHRACENE	0.10	-	Chicken	Acute	b (BaP)	1.00	10.00	Mouse	Reproduction	a (BaP)
BENZO(a)PYRENE	0.10	-	Chicken	Acute	b	1.00	10.00	Mouse	Reproduction	a
FLUORANTHENE	0.10	-	Chicken	Acute	b (BaP)	1.00	10.00	Mouse	Reproduction	a (BaP)
PHENANTHRENE	0.10	-	Chicken	Acute	b (BaP)	1.00	10.00	Mouse	Reproduction	a (BaP)
PYRENE	0.10	-	Chicken	Acute	b (BaP)	1.00	10.00	Mouse	Reproduction	a (BaP)
Dioxins										
2,3,7,8-TCDD	0.000014	0.00014	Ring-necked pheasant	Reproduction	a	0.000001	0.00001	Rat	Reproduction	a

Refernces:

(a) Toxicological Reference Values as cited in Appendix A of Sample, B.E., Opresko, D.M., and Suter, G.W. 1996. Toxicological Benchmakrs for Wildlife: 1996 Revision. Lockheed Martin Energy Systems, Inc. for U.S. Department of Energy, June 1996. ES/ER/TM-86/R3.

(b) Toxicological Reference Values as cited in Appendix D of EPA Region 6 RCRA Screening Level Ecological Risk Assessment Protocol for Hazardous Waste Combustion Facilities. Multimedia Planning and Permitting Division, August

Notes:

(1) List of important bioaccumulative compounds as identified in "Bioaccumulation Testing and Interpretation for the Purpose of Sediment Quality Assessment", United States Environmental Protection Agency, Office of Water/Office of Solid Waste, EPA-823-R-00-001, February 2000.

(BaP) indicates that the value for benzo(a)pyrene was used as a surrogate for this chemical, which had no available toxicological reference value.

(DDT) indicates that the value for 4,4'-DDT was used as a surrogate for this chemical, which had no available toxicological reference value.

(PCB-1254) indicates that the value for Aroclor-1254 was used as a surrogate for this chemical, which had no available toxicological reference value

Table 3-3
Approved Soil-to-Soil Invertebrate Biotransfer Factors for Food Chain Models in the ERA
Brown's *Dump Superfund Site*

Important Bioaccumulative Compounds [1]	Log K_{ow}	K_{ow}	Region 6 Published BTF	Sample et al (1998) BTF	Connell & Markwell Three Phase Model	Selected BTF	Selected Reference	Wet Weight to Dry Weight Conversion Factor [2]	[illegible] Assessment
Units ---->	Unitless	Unitless	BTF (mg COPC/ kg wet tissue) / (mg COPC/ kg dry soil)	BTF (mg COPC/ kg dry tissue) / (mg COPC/ kg dry soil)	BTF (mg COPC/ kg wet tissue) / (mg COPC/ kg dry soil)				(mg COPC/ kg wet tissue) / (mg COPC/ kg dry soil)
Reference ---->	a		b	c	d				
Inorganics									
ARSENIC	-	-	0.11	0.258	-	0.11	b	1	0.11
CADMIUM	-	-	0.98	17.105	-	0.98	b	1	0.86
CHROMIUM, TOTAL	-	-	0.01	1.099	-	0.01	b	1	0.01
COPPER	-	-	0.04	0.754	-	0.04	b	1	0.04
LEAD	-	-	0.03	3.342	-	0.03	b	1	0.03
NICKEL	-	-	0.02	1.656	-	0.02	b	1	0.02
SILVER	-	-	0.22	-	-	0.22	b	1	0.22
ZINC	-	-	0.56	5.766	-	0.56	b	1	0.50
MERCURY, as CHLORIDE	-	-	0.04	5.231	-	0.04	b	1	0.04
MERCURY, as METHYL	-	-	8.5	5.231	-	8.5	b	1	0.50
Pesticides									
ALDRIN	6.5	3162278	-	-	1.016	1.016	d	1	1.02
ALPHA-CHLORDANE	6.32	2089296	-	-	0.987	0.987	d	1	0.99
DIELDRIN	5.37	234423	-	-	0.847	0.847	d	1	0.05
GAMMA-CHLORDANE	6.32	2089296	-	-	0.987	0.987	d	1	0.90
p,p'-DDD	6.1	1258925	-	-	0.953	0.953	d	1	0.95
p,p'-DDE	6.76	5754399	1.26	-	1.060	1.260	b	1	1.26
p,p'-DDT	6.53	3388442	-	-	1.021	1.021	d	1	1.02
PCBs									
PCB-1260 (AROCHLOR 1260)	6.8	6309573	-	8.909	1.067	1.067	c	1.67	1.78
Semivolatile Organic Compounds									
ANTHRACENE	4.55	35481.3	-	-	0.742	0.742	d	1	0.74
BENZO(a)PYRENE	6.11	1288250	0.07	-	0.954	0.070	b	1	0.07
FLUORANTHENE	5.12	131826	-	-	0.814	0.814	d	1	0.01
PHENANTHRENE	4.55	35481.3	-	-	0.742	0.742	d	1	0.74
PYRENE	5.11	128825	-	-	0.812	0.812	d	1	0.01
Dioxins									
2,3,7,8-TCDD	6.53	3388442	1.59	11.74	1.021	1.590	b	1	1.59

References:

(a) Karickhoff and Long, 1995. Karickhoff, S.W. and Long, J.M., Internal Report on Summary of Measured, Calculated and Recommended Log Kow Values, Environmental Research Laboratory, Athens, Georgia.

(b) EPA 1999. EPA Region 6 RCRA Screening Level Ecological Risk Assessment Protocol for Hazardous Waste Combustion Facilities. *Multimedia Planning and Permitting Division*, August 1999.

(c) Sample B.E., Beauchamp J.J., Efroymson R.A., Suter G.W and Ashwood, T.L. 1998. Development and Validation of Bioaccumulation Models for Earthworms. Lockheed Martin Energy Systems, Inc. for U.S. Department of Engery. ES/ER/TM-220.

(d) Connell D.W. and R.D. Markwell. 1990. Bioaccumulation in the Soil to Earthworm System. Chemosphere, Vol. 20, Nos. 1-2, pp. 91-100, *Great Britain*, 1990.

$$BTF = [YL / (x\ F_{OC})] * K_{OW}^{b-a}$$

Where:

YL = Fraction lipid content of earthworms (0.0084 from Connell & Markwell 1990).

x = Proportionality constant (0.66 from Connell & Markwell 1990).

F_{OC} = Fraction organic carbon content in soil (3.57% from site specific data in Table 2-1).

K_{OW} = Octanol-water partitioning coefficient (from Karickhoff & Long 1995).

b-a = Nonlinearity constant (0.07 from Connell & Markwell 1990).

Notes:

(1) List of important bioaccumulative compounds as identified in "Bioaccumulation Testing and Interpretation for the Purpose of Sediment Quality Assessment", United States Environmental Protection Agency, Office of Water/Office of Solid Waste, EPA-823-R-00-001, February 2000.

(2) The reported values are presented as the amount of COPC in invertebrate tissue divided by the amount of COPC in the soil. If the values reported in the studies were 'presented as dry tissue weight over dry soil weight, they were converted to wet weight over dry weight by multiplying the concentration in dry earthworm tissue weight by a CF of 0.167. 'This conversion factor assumes an earthworm's total weight is 83.3 percent moisture (Pietz et al. 1984). conversion is necessary, the CF was set at 1.

Table 3-4
Food Chain Exposure Model for Terrestrial Vermivores
Brown's Dump Superfund Site

Important Bioaccumulative Compounds Detected in Site Samples [1]	Average Soil Concentration [2] (mg/KG)	Maximum Soil Concentration (mg/KG)	Soil-to-Invertebrate BTF	Average Invertebrate Tissue Concentration (mg/KG)	Maximum Invertebrate Tissue Concentration (mg/KG)	Vermivore	
						Average ADD (mg/kgBW-day)	Maximum ADD (mg/kgBW-day)
Data Source --->	Table 2-4	Table 2-4	Table X	Col. B * Col. D	Col. C * Col. D	See Eq. 1	See Eq. 1
Equation Variable --->	CS	CS		CPF	CPF	ADD	ADD
Inorganics							
ARSENIC	2.7	21.0	0.110	0.297	2.310	0.225	1.750
CADMIUM	1.0	8.7	0.960	0.960	8.352	0.611	5.319
CHROMIUM, TOTAL	10.3	81.0	0.010	0.103	0.810	0.218	1.718
COPPER	43.7	460.0	0.040	1.748	18.400	1.741	18.331
LEAD	67.4	43000.0	0.030	2.022	1290.000	1.863	1188.413
NICKEL	5.5	54.0	0.020	0.110	1.080	0.151	1.481
SILVER	1.0	5.1	0.220	0.220	1.122	0.152	0.774
ZINC	334.3	5200.0	0.560	187.208	2912.000	121.317	1887.080
MERCURY, as CHLORIDE	0.3	15.0	0.040	0.012	0.600	0.012	0.598
MERCURY, as METHYL	0.3	15.0	8.500	2.550	127.500	1.589	79.434
Pesticides							
ALDRIN	0.160	0.160	1.016	0.163	0.163	0.103	0.103
ALPHA-CHLORDANE	0.140	0.200	0.987	0.138	0.197	0.088	0.126
DIELDRIN	1.000	1.000	0.847	0.847	0.847	0.541	0.541
GAMMA-CHLORDANE	0.179	0.460	0.987	0.176	0.454	0.112	0.289
p,p'-DDD	0.044	0.044	0.953	0.042	0.042	0.027	0.027
p,p'-DDE	0.175	0.380	1.260	0.221	0.479	0.140	0.303
p,p'-DDT	0.330	1.000	1.021	0.337	1.021	0.214	0.650
PCBs							
PCB-1260 (AROCHLOR 1260)	0.062	0.260	1.781	0.110	0.463	0.069	0.292
Semivolatile Organic Compounds							
ANTHRACENE	0.160	0.190	0.742	0.119	0.141	0.076	0.090
BENZO(a)PYRENE	0.252	0.640	0.070	0.018	0.045	0.015	0.037
FLUORANTHENE	0.520	1.100	0.814	0.423	0.895	0.271	0.573
PHENANTHRENE	0.237	0.600	0.742	0.176	0.445	0.113	0.286
PYRENE	0.339	0.660	0.812	0.275	0.536	0.176	0.343
Dioxins							
2,3,7,8-TCDD	0.000015	0.000069	1.590	0.000023	0.000109	0.000015	0.000069

Ingestion Model:

Eq. 1) $ADD = [CPF * FDPF * AUF * adjNFIR] + [CS * AUF * NSIR * BAF]$

where:

CPF = Concentration of contaminant in food item (mg/KG)
CS = Concentration of contaminant in surface soil (mg/KG)
FDPF = Fraction of diet comprised of item.
AUF = Area use factor (assume 1, most conservative)
adjNFIR = Adjusted normalized ingestion rate (g/gBW-day, from USEPA Wildlife Exposure Factors Handbook)
NSIR = Normalized ingestion rate of soil (g/gBW-day, from USEPA Wildlife Exposure Factors Handbook)
BAF = Bioavailability of soil lead relative to dietary lead

Exposure Variables:

Surrogate Receptor: American Robin

Variable	Value	Units	Reference	Notes
AUF	1	unitless		Assumed for conservatism
NFIR	0.89	g/gBW-day	a	wet-weight basis
NSIR	0.015	g/gBW-day	a	10.4 % of NFIR, adjusted based on presumption that diet is 84% water.
$NFIR_{adj}$	0.875	g/gBW-day		NFIR - NSIR
FDPF	0.71	unitless	a	71% of American robin diet is invertebrates
BAF	0.6	unitless	b	Only used for lead

References:

a) EPA. 1993. U.S. Environmental Protection Agency, Office of Research and Development, Wildlife Exposure Factors Handbook, Vol. 1 of 2, EPA/600/R-93/187a, 1993.
b) EPA. 1999c. U.S. Environmental Protection Agency, Office of Research and Development, EPA 540-F-00-006, October 1999..

Notes:

'(1) List of important bioaccumulative compounds as identified in "Bioaccumulation Testing and Interpretation for the Purpose of Sediment Quality Assessment", United States Environmental Protection Agency, Office of Water/Office of Solid Waste, EPA-923-R-00-001, February 2000.
(2) The average listed in this table is the average of the detected concetrations. When the analyte was not detected in the dataset, the actual average is expected to be lower.

Table 3-5
Risk Characterization for Food Chain Exposure to Terrestrial Vermivores
Brown's Dump Superfund Site

Important Bioaccumulative Compounds Detected in Site Samples [1]	Exposure		Toxicity		Risk Characterization			
	Average ADD (mg/kgBW-day)	Maximum ADD (mg/kgBW-day)	NOAEL mg/kgBW-day	LOAEL mg/kgBW-day	HQ = Exposure/Toxicity			
					Average ADD		Maximum ADD	
	Exposure		Toxicity		NOAEL	LOAEL	NOAEL	LOAEL
Inorganics								
ARSENIC	0.225	1.750	2.5	7.4	0.091	0.030	0.711	0.237
CADMIUM	0.611	5.319	1.5	20.0	0.422	0.031	**3.668**	0.266
CHROMIUM, TOTAL	0.218	1.718	1.0	5.0	0.218	0.044	**1.718**	0.344
COPPER	1.741	18.331	47.0	61.7	0.037	0.028	0.390	0.297
LEAD	1.863	1188.413	1.1	11.3	**1.648**	0.165	**1051.692**	**105.169**
NICKEL	0.151	1.481	77.4	107.0	0.002	0.001	0.019	0.014
SILVER	0.152	0.774	1780.0	-	0.0001	-	0.0004	-
ZINC	121.317	1887.080	14.5	131.0	**8.37**	0.93	**130.14**	14.41
MERCURY, as CHLORIDE	0.012	0.598	0.0064	0.064	**1.8680**	0.1868	**93.40**	**9.340**
MERCURY, as METHYL	1.589	79.434	0.0064	0.064	**248.23**	**24.82**	**12411.62**	**1241.16**
Pesticides								
ALDRIN	0.103	0.103	0.1	-	**1.34**	-	**1.34**	-
ALPHA-CHLORDANE	0.088	0.126	2.1	10.7	0.04	0.01	0.06	0.01
DIELDRIN	0.541	0.541	0.1	-	**7.03**	-	**7.03**	-
GAMMA-CHLORDANE	0.112	0.289	2.1	10.7	0.05	0.01	0.14	0.03
p,p'-DDD	0.027	0.027	0.003	0.028	**9.54**	0.95	**9.54**	0.95
p,p'-DDE	0.140	0.303	-	84.5	-	0.002	-	0.004
p,p'-DDT	0.214	0.650	0.003	0.028	**76.55**	**7.65**	**231.97**	**23.20**
PCBs								
PCB-1260 (AROCHLOR 1260)	0.069	0.292	0.2	1.8	0.38	0.04	**1.62**	0.16
Semivolatile Organic Compounds								
ANTHRACENE	0.076	0.090	0.1	-	0.76	-	0.90	-
BENZO(a)PYRENE	0.015	0.037	0.1	-	0.15	-	0.37	-
FLUORANTHENE	0.271	0.573	0.1	-	**2.71**	-	**5.73**	-
PHENANTHRENE	0.113	0.286	0.1	-	**1.13**	-	**2.86**	-
PYRENE	0.176	0.343	0.1	-	**1.76**	-	**3.43**	-
Dioxins								
2,3,7,8-TCDD	0.000015	0.000069	0.000014	0.000140	**1.05**	0.11	**4.91**	0.49

Notes:

'(1) List of important bioaccumulative compounds as identified in "Bioaccumulation Testing and Interpretation for the Purpose of Sediment Quality Assessment", United States Environmental Protection Agency, Office of Water/Office of Solid Waste, EPA-823-R-00-001, February 2000.

Bold values in the risk characterization columns highlight those compounds with HQs greater than 1.

Table 3-6
Approved Soil-to-Plant Biotransfer Factors for Food Chain Models in the ERA
Brown's Dump Superfund Site

Important Bioaccumulative Compounds[1]	Log K_{ow}	K_{ow}	Region 6 Published BTF	Bechtel Jacobs (1998) BTF	Travis and Arms Biotransfer Factor Model	Selected BTF	Selected Reference	Wet Weight to Dry Weight Conversion Factor [2]	**BTF Used In Risk Assessment**
Units ---->	Unitless	Unitless	**BTF** (mg COPC/ kg dry tissue) / (mg COPC/ kg dry soil)	**BTF** (mg COPC/ kg dry tissue) / (mg COPC/ kg dry soil)	**BTF** (mg COPC/ kg dry tissue) / (mg COPC/ kg dry soil)				**(mg COPC/ kg wet tissue) / (mg COPC/ kg dry soil)**
Reference ---->	a		b	c	d				
Inorganics									
ARSENIC	-	-	0.036	0.0371	-	0.036	b	0.2	**0.0072**
CADMIUM	-	-	0.364	0.514	-	0.364	b	0.2	**0.0728**
CHROMIUM, TOTAL	-	-	0 0075	-	-	0 0075	b	0.2	**0.0015**
COPPER	-	-	0.4	0.123	-	0.4	b	0.2	**0.0800**
LEAD	-	-	0.045	0.0377	-	0.045	b	0.2	**0.0090**
NICKEL	-	-	0.032	0 0342	-	0.032	b	0.2	**0.0064**
SILVER	-	-	0 4	-	-	0.4	b	0 2	**0.0800**
ZINC	-	-	1.2E-12	-	-	1.2E-12	b	0.2	**2.40E-13**
MERCURY, METHYL	-	-	0.137	0 344	-	0.137	b	0.2	**0.0274**
Pesticides									
ALDRIN	6.5	3162278	-	-	0.007	0.007	d	0.2	**0.0014**
ALPHA-CHLORDANE	6 32	2089296	-	-	0.009	0 009	d	0.2	**0.0017**
DIELDRIN	5.37	234423	-	-	0 030	0.030	d	0.2	**0.0061**
GAMMA-CHLORDANE	6.32	2089296	-	-	0 009	0.009	d	0.2	**0.0017**
p,p'-DDD	6.1	1258925	-	-	0.012	0.012	d	0.2	**0.0023**
p,p'-DDE	6.76	5754399	0.00937	-	0.005	0.00937	b	0 2	**0.0019**
p,p'-DDT	6.53	3388442	-	-	0.007	0.007	d	0.2	**0.0013**
PCBs									
PCB-1260 (AROCHLOR 1260)	6.8	6309573	-	-	0.005	0 005	d	0.2	**0.0009**
Semivolatile Organic Compounds									
ANTHRACENE	4.55	35481.3	-	-	0.091	0.091	d	0 2	**0.0182**
BENZO(a)PYRENE	6.11	1288250	0.0202	-	0.011	0.0202	b	0.2	**0.0040**
FLUORANTHENE	5.12	131826	-	-	0.043	0.043	d	0.2	**0.0085**
PHENANTHRENE	4.55	35481.3	-	-	0.091	0.091	d	0.2	**0.0182**
PYRENE	5.11	128825	-	-	0.043	0 043	d	0.2	**0.0086**
Dioxins									
2,3,7,8-TCDD	6.53	3388442	0.0056	-	0.007	0.006	b	0.2	**0.0011**

Refernces:

(a) Karickhoff and Long, 1995. Karickhoff, S.W, and Long, J.M., Internal Report on Summary of Measured, Calculated and Recommended Log Kow Values, Environmental Research Laboratory, Athens, Georgia.
(b) EPA 1999. EPA Region 6 RCRA Screening Level Ecological Risk Assessment Protocol for Hazardous Waste Combustion Facilities. Multimedia Planning and Permitting Division, August 1999.
(c) Bechtel Jacobs Company 1998. Empirical Models for the Uptake of Inoganic Chemicals by Plants. Prepared for the U.S. Department of Engery. BJC/OR-133.
(d) Travis, C.C., and A.D Arms. 1988. Bioconcentration of Organics in beef, milk, and vegetation. Environ. Sci. Technol. 22(3):271-274.

$$BTF = 10^{(1.588-0.578(\log Kow))}$$

Where:

K_{OW} = Octanol-water partitioning coefficient (from Karickhoff & Long 1995).

Notes:

(1) List of important bioaccumulative compounds as identified in "Bioaccumulation Testing and Interpretation for the Purpose of Sediment Quality Assessment", United States Environmental Protection Agency, Office of Water/Office of Solid Waste, EPA-823-R-00-001, February 2000.

(2) The reported values are presented as the amount of COPC in plant tissue divided by the amount of COPC in the soil. If the values reported in the studies were 'presented as dry tissue weight over dry soil weight, they were converted to wet weight over dry weight by multiplying the concentration in dry plant tissue weight by a CF of 0.2. 'This conversion factor assumes the plants total weight is 80 percent moisture. If no conversion is necessary, the CF was set at 1.

Table 3-7
Food Chain Exposure Model for Terrestrial Herbivores
Brown's Dump Superfund Site

Important Bioaccumulative Compounds Detected in Site Samples [1]	Average Soil Concentration [2] (mg/KG)	Maximum Soil Concentration (mg/KG)	Soil-to-Plant BTF	Average Plant Tissue Concentration (mg/KG)	Maximum Plant Tissue Concentration (mg/KG)	Herbivore	
						Average ADD (mg/kgBW-day)	Maximum ADD (mg/kgBW-day)
Data Source ---->	*Table 2-4*	*Table 2-4*	*Table X*	*Col. B * Col. D*	*Col. C * Col. D*	*See Eq. 1*	*See Eq. 1*
Equation Variable ---->	CS	CS		CPF	CPF	ADD	ADD
Inorganics							
ARSENIC	2.70	21	0.007	0.019	0.151	0.022	0.170
CADMIUM	1.00	9	0.073	0.073	0.633	0.030	0.259
CHROMIUM, TOTAL	10.30	81	0.002	0.015	0.122	0.064	0.503
COPPER	43.70	460	0.080	3.496	36.800	1.405	14.791
LEAD	67.40	43000	0.009	0.607	387.000	0.431	275.279
NICKEL	5.50	54	0.006	0.035	0.346	0.043	0.423
SILVER	1.00	5	0.080	0.080	0.408	0.032	0.164
ZINC	334.30	5200	2.40E-13	8.02E-11	1.25E-09	1.910	29.702
MERCURY, METHYL	0.30	15	0.027	0.008	0.411	0.004	0.222
Pesticides							
ALDRIN	0.160	0.160	0.001	0.0002	0.000	0.00099	0.00099
ALPHA-CHLORDANE	0.140	0.200	0.002	0.0002	0.000	0.000876	0.001256
DIELDRIN	1.000	1.000	0.006	0.0061	0.006	0.007727	0.007727
GAMMA-CHLORDANE	0.179	0.460	0.002	0.0003	0.001	0.001122	0.002889
p,p'-DDD	0.044	0.044	0.002	0.0001	0.000	0.000285	0.00028
p,p'-DDE	0.175	0.380	0.002	0.0003	0.001	0.00111	0.00241
p,p'-DDT	0.330	1.000	0.001	0.0004	0.001	0.00203	0.00614
PCBs							
PCB-1260 (AROCHLOR 1260)	0.062	0.260	0.001	0.0001	0.0002	0.00037	0.0016
Semivolatile Organic Compounds							
ANTHRACENE	0.160	0.190	0.018	0.003	0.003	0.0019	0.002
BENZO(a)PYRENE	0.252	0.640	0.004	0.001	0.003	0.0018	0.005
FLUORANTHENE	0.520	1.100	0.009	0.004	0.009	0.0044	0.009
PHENANTHRENE	0.237	0.600	0.018	0.004	0.011	0.0028	0.007
PYRENE	0.339	0.660	0.009	0.003	0.006	0.0029	0.006
Dioxins							
2,3,7,8-TCDD	*0.000015*	*0.000069*	0.001	0.000000	0.000000	0.000000089	0.000000417

Ingestion Model:

Eq. 1) $ADD = [CPF * FDPF * AUF * adjNFIR] + [CS * AUF * NSIR * BAF]$

where:

CPF = Concentration of contaminant in food item (mg/KG)
CS = Concentration of contaminant in surface soil (mg/KG)
FDPF = Fraction of diet comprised of item.
AUF = Area use factor (assume 1, most conservative)
adjNFIR = Adjusted normalized ingestion rate (g/gBW-day, from USEPA Wildlife Exposure Factors Handbook)
NSIR = Normalized ingestion rate of soil (g/gBW-day, from USEPA Wildlife Exposure Factors Handbook)
BAF = Bioavailability of soil lead relative to dietary lead

Exposure Variables:

Surrogate Receptor: Meadow vole

Variable	Value	Units	Reference	Notes
AUF	1	*unitless*		*Assumed for conservatism*
NFIR	0.35	g/gBW-day	a	wet-weight basis
NSIR	0.005712	g/gBW-day	a	2.4 % of NFIR, adjusted based on presumption that moisture content of diet is 32%
$NFIR_{adj}$	0.344288	g/gBW-day		NFIR - NSIR
FDPF	0.96		a	96% of meadow vole diet is plants
BAF	0.6	unitless	b	Only used for lead

References:

a) EPA. 1993. U.S. Environmental Protection Agency, Office of Research and Development, Wildlife Exposure Factors Handbook, Vol. 1 of 2, EPA/600/R-93/187a, 1993.
b) EPA. 1999c. *U.S. Environmental Protection Agency, Office of Research and Development*, EPA 540-F-00-006, October 1999..

Notes:

(1) List of important bioaccumulative compounds as identified in "Bioaccumulation Testing and Interpretation for the Purpose of Sediment Quality Assessment", United States Environmental Protection Agency, Office of Water/Office of Solid Waste, EPA-823-R-00-001, February 2000.
(2) The average listed in this table is the average of the detected concetrations. When the analyte was not detected in the dataset, the actual average is expected to be lower.

Table 8
Risk Characterization for Food Chain Exposure to Terrestrial Herbivores
Brown's Dump Superfund Site

Important Bioaccumulative Compounds Detected in Site Samples [1]	Exposure		Toxicity		Risk Characterization			
	Average ADD (mg/kgBW-day)	Maximum ADD (mg/kgBW-day)	NOAEL mg/kgBW-day	LOAEL mg/kgBW-day	HQ = Exposure/Toxicity			
					Average ADD		Maximum ADD	
	Exposure		Toxicity		NOAEL	LOAEL	NOAEL	LOAEL
Inorganics								
ARSENIC	0.022	0.170	0.12600	1.26000	0.173	0.017	**1.349**	0.135
CADMIUM	0.030	0.259	1.00000	10.00000	0.030	0.003	0.259	0.026
CHROMIUM, TOTAL	0.064	0.503	2737.00000	-	0.00002	-	0.00018	-
COPPER	1.405	14.791	11.70000	15.14000	0.120	0.093	**1.264**	0.977
LEAD	0.431	275.279	8.00000	80.00000	0.054	0.005	**34.410**	**3.441**
NICKEL	0.043	0.423	40.00000	80.00000	0.001	0.001	0.011	0.005
SILVER	0.032	0.164	-	3.75000	-	0.009	-	0.044
ZINC	1.910	29.702	160.00000	320.00000	0.012	0.006	0.186	0.093
MERCURY	0.004	0.222	0.03200	0.16000	0.138	0.028	**6.923**	**1.385**
Pesticides								
ALDRIN	0.00099	0.00099	0.20000	1.00000	0.005	0.001	0.005	0.001
ALPHA-CHLORDANE	0.00088	0.00126	4.60000	9.20000	0.0002	0.0001	0.0003	0.0001
DIELDRIN	0.00773	0.00773	0.02000	0.20000	0.386	0.039	0.386	0.039
GAMMA-CHLORDANE	0.00112	0.00289	4.60000	9.20000	0.0002	0.0001	0.0006	0.0003
p,p'-DDD	0.00028	0.00028	0.80000	4.00000	0.0004	0.0001	0.0004	0.0001
p,p'-DDE	0.00111	0.00241	10.00000	-	0.0001	-	0.0002	-
p,p'-DDT	0.00203	0.00614	0.80000	4.00000	0.0025	0.0005	0.0077	0.0015
PCBs								
PCB-1260 (AROCHLOR 1260)	0.0004	0.002	0.06800	0.68000	0.005	0.001	0.023	0.002
Semivolatile Organic Compounds								
ANTHRACENE	0.00187	0.00223	1.00000	10.00000	0.0019	0.0002	0.0022	0.0002
BENZO(a)PYRENE	0.00178	0.00451	1.00000	10.00000	0.0018	0.0002	0.0045	0.0005
FLUORANTHENE	0.00443	0.00938	1.00000	10.00000	0.0044	0.0004	0.0094	0.0009
PHENANTHRENE	0.00277	0.00703	1.00000	10.00000	0.0028	0.0003	0.0070	0.0007
PYRENE	0.00290	0.00565	1.00000	10.00000	0.0029	0.0003	0.0057	0.0006
Dioxins								
2,3,7,8-TCDD	0.00000009	0.00000042	0.000001	0.000010	0.089	0.009	0.417	0.042

Notes:

'(1) List of important bioaccumulative compounds as identified in "Bioaccumulation Testing and Interpretation for the Purpose of Sediment Quality Assessment", United States Environmental Protection Agency, Office of Water/Office of Solid Waste, EPA-823-R-

Bold values in the risk characterization columns highlight those compounds with HQs greater than 1.

3 12 0222

Table 3-9
Approved Soil-to-Vertebrate Biotransfer Factors for Food Chain Models in the ERA
Brown's Dump Superfund Site

Important Bioaccumulative Compounds[1]	Log K_{ow}	K_{ow}	Region 6 Published BTF	Sample et al. (1998) BTF	Selected BTF	Selected Reference	Wet Weight to Dry Weight Conversion Factor [2]	BTF Used in Risk Assessment
Units ---->	Unitless	Unitless	BTF (mg COPC/ kg wet tissue) / (mg COPC/ kg dry soil)	BTF (mg COPC/ kg dry tissue) / (mg COPC/ kg dry soil)				(mg COPC/ kg wet tissue) / (mg COPC/ kg dry soil)
Reference ---->	a		b	c				
Inorganics								
ARSENIC	-	-	0.0000273	0.0067	0.0000273	b	1	**0.000027**
CADMIUM	-	-	0.0044	4.8127	0.0044	b	1	**0.0044**
CHROMIUM, TOTAL	-	-	0.000075	0.1468	0.000075	b	1	**0.0001**
COPPER	-	-	-	0.6857	0.6857	c	0.32	**0.2194**
LEAD	-	-	0.00000409	0.2541	0.00000409	b	1	**0.0000**
NICKEL	-	-	0.0000818	0.3487	0.0000818	b	1	**0.0001**
SILVER	-	-	0.00004009	0.279	0.00004009	b	1	**0.000040**
ZINC	-	-	0.000363	1.46716	0.000363	b	1	**0.0004**
MERCURY, METHYL	-	-	0.000992	1.0457	0.000992	b	1	**0.0010**
Pesticides								
ALDRIN	6.5	3162278	-	-	-	b (DDE)	1	**0.00149**
ALPHA-CHLORDANE	6.32	2089296	-	-	-	b (DDE)	1	**0.00149**
DIELDRIN	5.37	234423	-	-	-	b (DDE)	1	**0.00149**
GAMMA-CHLORDANE	6.32	2089296	-	-	-	b (DDE)	1	**0.00149**
p,p'-DDD	6.1	1258925	-	-	-	b (DDE)	1	**0.00149**
p,p'-DDE	6.76	5754399	0.00149	-	0.00149	b	1	**0.00149**
p,p'-DDT	6.53	3388442	-	-	-	b (DDE)	1	**0.00149**
PCBs								
PCB-1260 (AROCHLOR 1260)	6.8	6309573	-	-	-	b (PCB-1254)	1	**0.001320**
Semivolatile Organic Compounds								
ANTHRACENE	4.55	35481.3	-	-	-	b (BaP)	1	**0.0011**
BENZO(a)PYRENE	6.11	1288250	0.001110	-	0.001100	b	1	**0.0011**
FLUORANTHENE	5.12	131826	-	-	-	b (BaP)	1	**0.0011**
PHENANTHRENE	4.55	35481.3	-	-	-	b (BaP)	1	**0.0011**
PYRENE	5.11	128825	-	-	-	b (BaP)	1	**0.0011**
Dioxins								
2,3,7,8-TCDD	6.53	3388442	14.3	1.2857	14.300	b	1	**14.3000**

References:

(a) Karickhoff and Long, 1995. Karickhoff, S.W. and Long, J.M., Internal Report on Summary of Measured, Calculated and Recommended Log Kow Values, Environmental Research Laboratory, Athens, Georgia.

(b) EPA 1999. EPA Region 6 RCRA Screening Level Ecological Risk Assessment Protocol for Hazardous Waste Combustion Facilities. Multimedia Planning and Permitting Division, August 1999.

(c) Sample B.E., Beauchamp J.J., Efroymson R A , and Suter G.W. 1998. Development and Validation of Bioaccumulation Models for Small Mammals. Lockheed Martin Energy Systems, Inc. for U.S.

Notes:

(1) List of important bioaccumulative compounds as identified in "Bioaccumulation Testing and Interpretation for the Purpose of Sediment Quality Assessment", United States Environmental Protection Agency, Office of Water/Office of Solid Waste, EPA-823-R-00-001, February 2000.

(2) The reported values are presented as the amount of COPC in animal tissue divided by the amount of COPC in the soil. If the values reported in the studies were 'presented as dry tissue weight over dry soil weight, they were converted to wet weight over dry weight by multiplying the concentration in dry animal tissue weight by a CF of 0.32. 'This conversion factor assumes the tissue total weight is 68 percent moisture. If no conversion is necessary, the CF was set at 1.

(BaP) indicates that the value for benzo(a)pyrene was used as a surrogate for this chemical, which had no available BTF.

(DDE) indicates that the value for 4,4'-DDE was used as a surrogate for this chemical, which had no available BTF.

(PCB-1254) indicates that the value for Aroclor-1254 was used as a surrogate for this chemical, which had no available BTF.

Table 3-10
Food Chain Exposure Model for Terrestrial Carnivores
Brown's Dump Superfund Site

Important Bioaccumulative Compounds Detected in Site Samples [1]	Average Soil Concentration [2] (mg/KG)	Maximum Soil Concentration (mg/KG)	Soil-to-Vertebrate BTF	Average Vertebrate Tissue Concentration (mg/KG)	Maximum Vertebrate Tissue Concentration (mg/KG)	Carnivore	
						Average ADD (mg/kgBW-day)	Maximum ADD (mg/kgBW-day)
Data Source ---->	Table 2-4	Table 2-4	Table X	Col. B * Col. D	Col. C * Col. D	See Eq. 1	See Eq. 1
Equation Variable ---->	CS	CS		CPF	CPF	ADD	ADD
Inorganics							
ARSENIC	2.70	21	0.00003	0.00007	0.00057	0.0019	0.0148
CADMIUM	1.00	9	0.0044	0.00440	0.03828	0.0012	0.0103
CHROMIUM, TOTAL	10.30	81	0.0001	0.00077	0.00608	0.0073	0.0577
COPPER	43.70	460	0.2194	9.58883	100.93504	1.0788	11.3556
LEAD	67.40	43000	0.00000	0.00028	0.17587	0.0285	18.1824
NICKEL	5.50	54	0.0001	0.00045	0.00442	0.0039	0.0385
SILVER	1.00	5	0.00004	0.00004	0.00020	0.0007	0.0036
ZINC	334.30	5200	0.0004	0.12135	1.88760	0.2486	3.8671
MERCURY, METHYL	0.30	15	0.0010	0.00030	0.01488	0.0002	0.0122
Pesticides							
ALDRIN	0.160	0.160	0.001	0.00024	0.00024	0.0001	0.0001
ALPHA-CHLORDANE	0.140	0.200	0.001	0.00021	0.00030	0.0001	0.0002
DIELDRIN	1.000	1.000	0.001	0.00149	0.00149	0.001	0.001
GAMMA-CHLORDANE	0.179	0.460	0.001	0.00027	0.00069	0.0002	0.0004
p,p'-DDD	0.044	0.044	0.001	0.00007	0.00007	0.00004	0.0000
p,p'-DDE	0.175	0.380	0.001	0.00026	0.00057	0.00015	0.0003
p,p'-DDT	0.330	1.000	0.001	0.00049	0.00149	0.00029	0.0009
PCBs							
PCB-1260 (AROCHLOR 1260)	0.062	0.260	0.001	0.00008	0.00034	0.0001	0.0002
Semivolatile Organic Compounds							
ANTHRACENE	0.160	0.190	0.0011	0.00018	0.00021	0.0001	0.000
BENZO(a)PYRENE	0.252	0.640	0.0011	0.00028	0.00070	0.0002	0.0005
FLUORANTHENE	0.520	1.100	0.0011	0.00057	0.00121	0.0004	0.0009
PHENANTHRENE	0.237	0.600	0.001	0.00026	0.00066	0.0002	0.0005
PYRENE	0.339	0.660	0.001	0.00037	0.00073	0.0003	0.001
Dioxins							
2,3,7,8-TCDD	0.000015	0.000069	14.300	0.00021	0.00098	0.00002	0.00011

Ingestion Model:

Eq. 1) $ADD = [CPF * FDPF * AUF * adjNFIR] + [CS * AUF * NSIR * BAF]$

where:

CPF = Concentration of contaminant in food item (mg/KG)
CS = Concentration of contaminant in surface soil (mg/KG)
FDPF = Fraction of diet comprised of item.
AUF = Area use factor (assume 1, most conservative)
adjNFIR = Adjusted normalized ingestion rate (g/gBW-day, from USEPA Wildlife Exposure Factors Handbook)
NSIR = Normalized ingestion rate of soil (g/gBW-day, from USEPA Wildlife Exposure Factors Handbook)
BAF = Bioavailability of soil lead relative to dietary lead

Exposure Variables:

Surrogate Receptor: Red-tailed hawk

Variable	Value	Units	Reference	Notes
AUF	1	unitless		Assumed for conservatism
NFIR	0.11	g/gBW-day	a	wet-weight basis
NSIR	0.000704	g/gBW-day	a	2 % of NFIR, adjusted based on presumption that moisture content of diet is 68%
$NFIR_{adj}$	0.109296	g/gBW-day		NFIR - NSIR
FDPF	1		a	100% of red-tailed hawk diet is small vertebrates
BAF	0.6	unitless	b	Only used for lead

References:

a) EPA. 1993. U.S. Environmental Protection Agency, Office of Research and Development, Wildlife Exposure Factors Handbook, Vol. 1 of 2, EPA/600/R-93/187a, 1993.
b) EPA. 1999c. U.S. Environmental Protection Agency, Office of Research and Development, EPA 540-F-00-006, October 1999..

Notes:

(1) List of important bioaccumulative compounds as identified in "Bioaccumulation Testing and Interpretation for the Purpose of Sediment Quality Assessment", United States Environmental Protection Agency, Office of Water/Office of Solid Waste, EPA-823-R-00-001, February 2000.
(2) The average listed in this table is the average of the detected concetrations. When the analyte was not detected in the dataset, the actual average is expected to be lower.

Table 3-11
Risk Characterization for Food Chain Exposure to Terrestrial Carnivores
Brown's Dump Superfund Site

Important Bioaccumulative Compounds Detected in Site Samples [1]	Exposure		Toxicity		Risk Characterization			
	Average ADD (mg/kgBW-day)	Maximum ADD (mg/kgBW-day)	NOAEL mg/kgBW-day	LOAEL mg/kgBW-day	HQ = Exposure/Toxicity			
					Average ADD		Maximum ADD	
	Exposure		Toxicity		NOAEL	LOAEL	NOAEL	LOAEL
Inorganics								
ARSENIC	0.002	0.015	2.46000	7.38000	0.0008	0.0003	0.0060	0.0020
CADMIUM	0.001	0.010	1.45000	20.00000	0.0008	0.0001	0.0071	0.0005
CHROMIUM, TOTAL	0.007	0.058	1.00000	5.00000	0.0073	0.0015	0.0577	0.0115
COPPER	1.079	11.356	47.00000	61.70000	0.0230	0.0175	0.24	0.1840
LEAD	0.028	18.182	1.13000	11.30000	0.0252	0.0025	**16.09**	**1.6091**
NICKEL	0.004	0.038	77.40000	107.00000	0.0001	0.00004	0.0005	0.0004
SILVER	0.001	0.004	1780.00000	-	0.0000004	-	0.000002	-
ZINC	0.249	3.867	14.50000	131.00000	0.0171	0.0019	0.2667	0.0295
MERCURY	0.0002	0.012	0.00640	0.06400	0.0381	0.0038	**1.90**	0.1904
Pesticides								
ALDRIN	0.00014	0.00014	0.07700	-	0.0018	-	0.0018	-
ALPHA-CHLORDANE	0.00012	0.00017	2.14000	10.70000	0.0001	0.0000	0.0001	0.00002
DIELDRIN	0.00087	0.00087	0.07700	-	0.0113	-	0.0113	-
GAMMA-CHLORDANE	0.00015	0.00040	2.14000	10.70000	0.0001	0.0000	0.0002	0.00004
p,p'-DDD	0.00004	0.00004	0.00280	0.02800	0.0136	0.0014	0.0136	0.0014
p,p'-DDE	0.00015	0.00033	-	84.50000	-	0.000002	-	0.000004
p,p'-DDT	0.00029	0.00087	0.00280	0.02800	0.10	0.01	0.31	0.03
PCBs								
PCB-1260 (AROCHLOR 1260)	0.0001	0.0002	0.18000	1.80000	0.0003	0.00003	0.0012	0.0001
Semivolatile Organic Compounds								
ANTHRACENE	0.00013	0.00016	0.10000	-	0.001	-	0.002	-
BENZO(a)PYRENE	0.00021	0.00053	0.10000	-	0.002	-	0.005	-
FLUORANTHENE	0.00043	0.00091	0.10000	-	0.004	-	0.009	-
PHENANTHRENE	0.00020	0.00049	0.10000	-	0.002	-	0.005	-
PYRENE	0.00028	0.00054	0.10000	-	0.003	-	0.005	-
Dioxins								
2,3,7,8-TCDD	0.00002299	0.00010727	0.000014	0.000140	**1.642**	0.1642	**7.66**	0.766

Notes:

'(1) List of important bioaccumulative compounds as identified in "Bioaccumulation Testing and Interpretation for the Purpose of Sediment Quality Assessment", United States Environmental Protection Agency, Office of Water/Office of Solid Waste, EPA-823-R-00-001, February

Bold values in the risk characterization columns highlight those compounds with HQs greater than 1.

Table 5-12
Contaminants of Potential Ecological Concern (COPEC) for Food Chain Exposure
Brown's Dump Superfund Site

Surface Soil				Sediment	
COPC w/Average LOAEL HQ> 1	Vermivores	Herbivores	Carnivores	*COPC w/Average LOAEL HQ> 1*	Insectivores
LEAD	X			None	
ZINC	X				
MERCURY	X				
4,4-DDT	X				

Table 3-13
Approved Sediment-to-Invertebrate Biotransfer Factors for Food Chain Models in the ERA
Brown's Dump Superfund Site

Important Bioaccumulctivo Compounds [1]	Log K_{ow}	K_{ow}	Region 6 Published BTF	Sample et al. (1999) BTF	USACOE BASF Database	Southworth et al Biotransfer Factor Model	Other	Selected BTF	Selected Reference	Wet Weight to Dry Weight Conversion Factor [2]	Max Used in Risk Assessment
Units ---->	Unitless	Unitless	BTF (mg COPC/ kg wet tissue) / (mg COPC/ kg dry soil)	BTF (mg COPC/ kg dry tissue) / (mg COPC/ kg dry soil)	BTF (mg COPC/ kg wet tissue) / (mg COPC/ kg dry soil)	BTF (mg COPC/ kg dry tissue) / (mg COPC/ kg dry soil)	BTF (mg COPC/ kg wet tissue) / (mg COPC/ kg dry soil)				(mg COPC/ kg wet tissue) / (mg COPC/ kg dry soil)
Reference ---->	a		b	c	d	e					
Inorganics											
LEAD	-	-	0.63	0.276				0.63	b	1	**0.63**
Pesticides											
ALPHA-CHLORDANE	6.32	2089296			2.36	10717.167		2.36	d	1	**2.36**
GAMMA-CHLORDANE	6.32	2089296			1.17	10717.167		1.17	-	1	**1.17**
p,p'-DDE	6.76	5754399	0.95		1.21	24571.971		1.21	b	1	**1.21**
p,p'-DDT	6.53	3388442			0.38	15924.654		0.38	-	1	**0.38**
Semivolatile Organic Compounds											
BENZO(a)ANTHRACENE	5.7	501187	1.45			3328.894		1.45	b	1	**1.45**
PYRENE	5.11	128825			0.63	1094.183		0.63	d	1	**0.63**

Refernces:

(a) Karickhoff and Long, 1995. Karickhoff, S.W. and Long, J.M., Internal Report on Summary of Measured, Calculated and Recommended Log Kow Values, Environmental Research Laboratory, Athens, Georgia.

(b) EPA 1999. EPA Region 6 RCRA Screening Level Ecological Risk Assessment Protocol for Hazardous Waste Combustion Facilities. *Multimedia Planning and Permitting Division, August 1999.*

(c) Bechtel Jacobs Company 1998. Biot Sediment Accumulation Factors for Invertebrates. Review and Recommendations for the Oak Ridge Reservation. Prepared for the U.S. Department of Energy. BJC/OR-112. August 1998.

(d) U.S. Army Corps of Engineers 1999. The BSAF Database, Windows Version 2.0. USACE Waterways Experiment Station (WES). March 1998.

(e) Southworth, G.R , J.J. Beauchamp, and P.K. Schmieder. 1978. "Bioaccumulation Potential of Polycyclic *Aromatic Hydrocarbons in Daphnia Pulex.*" Water Research. Volume 12. Pages 973-977. As cited in Lyman, Reehl, and Rosenblatt (1982). As cited in Lyman, Reehl, and Rosenblatt (1982).

(f) Froese, Kenneth L., David A. Verbrugge, John P. Giesy, Gerald T. Ankley, Gerald J. Niemi, Christen P. Larsen, 1998: Bioaccumulation Of Polychlorinated Biphenyls From Sediments To Aquatic Insects And Tree Swallow Eggs And Nestlings In Saginaw Bay, Michigan, USA.

Notes:

(1) List of important bioaccumulative compounds as identified in "Bioaccumulation Testing and Interpretation for the Purpose of Sediment Quality Assessment", United States Environmental Protection Agency, Office of Water/Office of Solid Waste, EPA-823-R-00-001, February 2000.

(2) The reported values are presented as the amount of COPC in invertebrate tissue divided by the amount of COPC in the soil. If the values reported in the studies were 'presented as dry tissue weight over dry soil weight, they were converted to wet weight over dry weight by multiplying the concentration in dry invertebrate tissue weight by a CF of 0.167. 'This conversion factor assumes an invertebrate's total weight is 83.3 percent moisture. If no conversion is necessary, the CF was set at 1.

Table 3-14
Food Chain Exposure Model for Aquatic Insectivore
Brown's Dump Superfund Site

Important Bioaccumulative Compounds Detected in Site Samples [1]	Average Sediment Concentration [2] (mg/KG)	Maximum Sediment Concentration (mg/KG)	Soil-to-Aquatic Invertebrate BTF	Average Invertebrate Tissue Concentration (mg/KG)	Maximum Invertebrate Tissue Concentration (mg/KG)	Aquatic Insectivore	
						Average ADD (mg/kgBW-day)	Maximum ADD (mg/kgBW-day)
Data Source --->	Table 2-1	Table 2-1	Table X	Col. B * Col. D	Col. C * Col. D	See Eq. 1	See Eq. 1
Equation Variable --->	CS	CS		CPF	CPF	ADD	ADD
Inorganics							
LEAD	21.40	46	0.63000	13.48200	28.98000	0.650	1.397
Pesticides							
ALPHA-CHLORDANE	0.0005	0.0008	2.360	0.00127	0.00184	0.00006	0.00009
GAMMA-CHLORDANE	0.0011	0.0015	1.170	0.00130	0.00176	0.00006	0.00008
p,p'-DDE	0.0013	0.0021	1.210	0.00152	0.00254	0.00007	0.00012
p,p'-DDT	0.0050	0.0050	0.380	0.00190	0.00190	0.000002	0.000002
Semivolatile Organic Compounds							
BENZO(a)ANTHRACENE	0.0490	0.0750	1.4500	0.07105	0.10875	0.003	0.005
PYRENE	0.1350	0.1800	0.630	0.08505	0.11340	0.004	0.005

Ingestion Model:

Eq. 1) ***ADD = [CPF * FDPF * AUF * adjNFIR] + [CS * AUF * NSIR * BAF]***

where:

CPF = Concentration of contaminant in food item (mg/KG)
CS = Concentration of contaminant in surface soil (mg/KG)
FDPF = Fraction of diet comprised of item.
AUF = Area use factor (assume 1, most conservative)
NSIR = Normalized ingestion rate of soil (g/gBW-day, from USEPA Wildlife Exposure Factors Handbook)
BAF = Bioavailability of soil lead relative to dietary lead

Exposure Variables:

Surrogate Receptor: Snowy Egret

Variable	Value	Units	Reference	Notes
AUF	0.097	unitless		Estimated based on foraging habitat area (2 acres) divided by territory area (20.7
NFIR	0.493	g/gBW-day	a	Calculated based on Eq. 3-3 using BW of 370 grams for snowy egret results in ingestion rate of 0.082 g/gDW-day. Assuming that diet is principally invertebrates with a water content of 83.3%, egret would be ingesting (0.082 * 5.99) or 0.493 g/gFW-day.
NSIR	0.0041	g/gBW-day	a	5 % of NFIR, as dry weight (i.e. 5% of 0.082 g/gBW-day).
FDPF	1		a	100% of egret diet is aquatic invertebrates
BAF	0.6	unitless	b	Only used for lead

References:

a) EPA. 1993. U.S. Environmental Protection Agency, Office of Research and Development, Wildlife Exposure Factors Handbook, Vol. 1 of 2, EPA/600/R-93/187a, 1993.
b) EPA. 1999c. U.S. Environmental Protection Agency, Office of Research and Development, EPA 540-F-00-006, October 1999..

Notes:

(1) List of important bioaccumulative compounds as identified in "Bioaccumulation Testing and Interpretation for the Purpose of Sediment Quality Assessment", United States Environmental Protection Agency, Office of Water/Office of Solid Waste, EPA-823-R-00-001, February 2000.
(2) The average listed in this table is the average of the detected concetrations. When the analyte was not detected in the dataset, the actual average is expected to be lower.

Table 3-15
Risk Characterization for Food Chain Exposure to Aquatic Insectivores
Brown's Dump Superfund Site

Important Bioaccumulative Compounds Detected in Site Samples [1]	Exposure		Toxicity		Risk Characterization			
	Average ADD (mg/kgBW-day)	Maximum ADD (mg/kgBW-day)	NOAEL mg/kgBW-day	LOAEL mg/kgBW-day	HQ = Exposure/Toxicity			
					Average ADD		Maximum ADD	
	Exposure		Toxicity		NOAEL	LOAEL	NOAEL	LOAEL
Inorganics								
LEAD	0.650	1.397	1.13000	11.30000	0.58	0.06	**1.24**	0.12
Pesticides								
ALPHA-CHLORDANE	0.00006	0.00009	2.14000	10.70000	0.00003	0.00001	0.00004	0.00001
GAMMA-CHLORDANE	0.00006	0.00008	2.14000	10.70000	0.00003	0.00001	0.00004	0.00001
p,p'-DDE	0.00007	0.00012	-	84.50000	-	0.000001	-	0.000001
p,p'-DDT	0.000002	0.000002	0.00280	0.02800	0.00071	0.00007	0.00071	0.00007
Semivolatile Organic Compounds								
BENZO(a)ANTHRACENE	0.00342	0.00523	0.10000	-	0.03	-	0.05	-
PYRENE	0.00412	0.00549	0.10000	-	0.04	-	0.05	-

Notes:

'(1) List of important bioaccumulative compounds as identified in "Bioaccumulation Testing and Interpretation for the Purpose of Sediment Quality Assessment", United States Environmental Protection Agency, Office of Water/Office of Solid Waste, EPA-823-R-00-001, February

Bold values in the risk characterization columns highlight those compounds with HQs greater than 1.

Table 5-1
Ecological Preliminary Remedial Goals for Surface Soils
Brown's Dump Superfund Site

Contaminant	Preliminary Remedial Goal	Driver
Inorganics (mg/KG)		
ALUMINUM	600	Direct exposure
ANTIMONY	5	Direct exposure
COPPER	61	Direct exposure
IRON	200	Direct exposure
LEAD	400 (a)	Food chain exposure
ZINC	200	Direct exposure
MERCURY (b)	0.012 (a)	Food chain exposure
Pesticide/PCBs (ug/KG)		
4,4-DDT	43	Food chain exposure

Notes:

a) Represents average soil concentration that should be the remedial goal for food chain exposure driven COPEC.

b) The PRG for mercury was based on methyl mercury. If mercuric chloride was the prevalent form, the PRG would be 1.6 mg/

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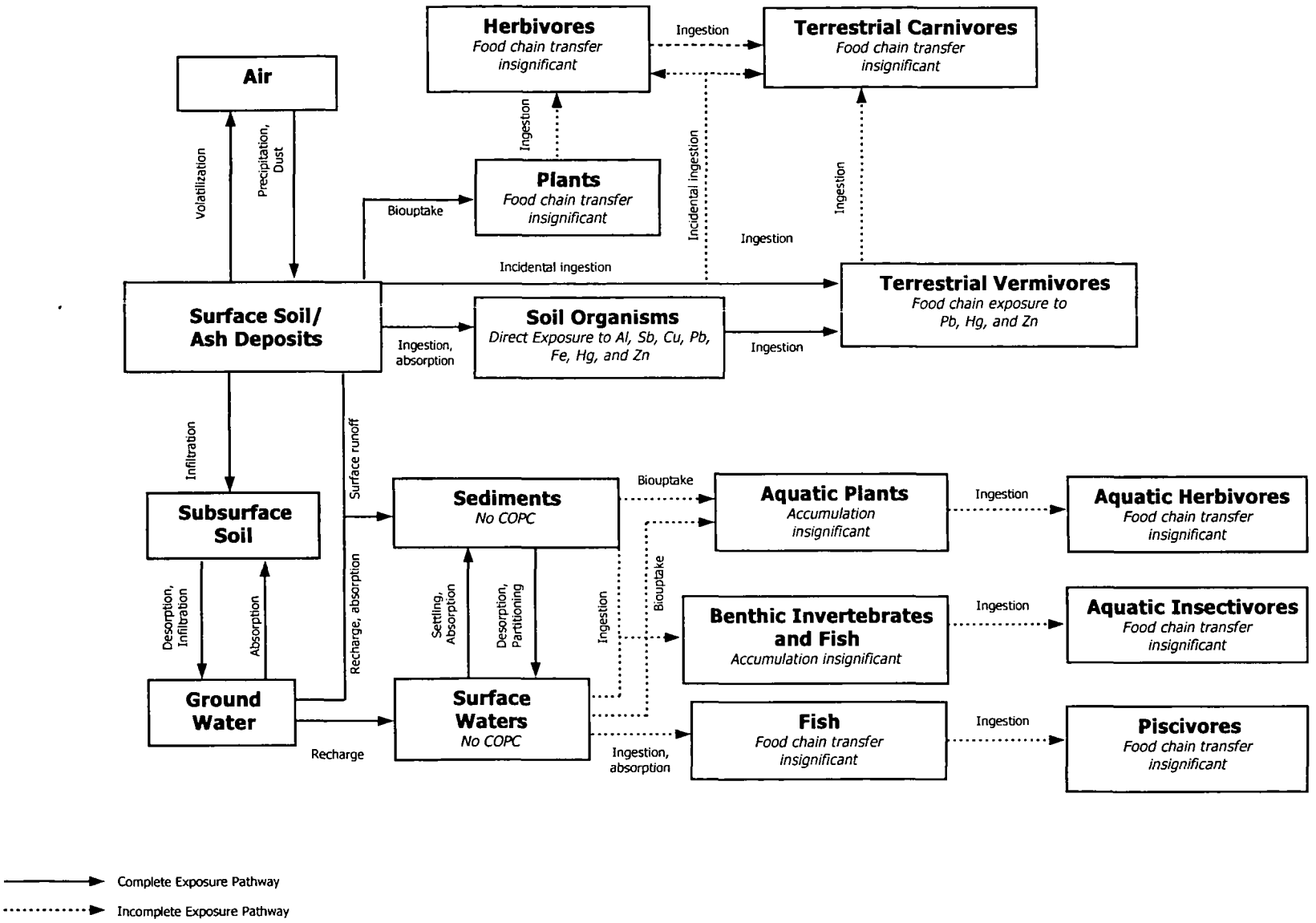

Brown's Dump Superfund Site
Ecological Risk Assessment
Jacksonville, Duval County, Florida

Figure 3-1
Potentially Complete Exposure Pathways

BLACK & VEATCH
the engineering-built company

3 12 0228

Appendix A

Screening Level Ecological Risk Assessment Steps 1, 2, and 3

Brown's Dump Site
City of Jacksonville
Duval County, Florida

Prepared by:

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March 15, 2000

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INTRODUCTION

This screening-level ecological risk assessment (SERA) presents an evaluation of the analytical data generated during investigations performed between July 1997 and December 1999, as it relates to ecological risk at the Brown's Dump Site, Jacksonville, Duval County, Florida. The methodology used in this assessment will be based on and will comply with the guidance available from USEPA Region 4 for conducting ecological risk assessments (USEPA 1998). This SERA also follows the latest guidance described in the *Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments* (USEPA 1997). The guidance outlines eight steps to complete the ecological risk assessment process at Superfund sites. This SERA completes Steps 1 and 2 of the Process Document:

- Step 1 - Screening - Level Problem Formulation and Ecological Effects Evaluation
- Step 2 - Screening - Level Exposure Estimate and Risk Calculation
- Step 3 - Baseline Risk Assessment Problem Formulation

When the conclusions of the initial two steps of the process, the SERA, conclude that further action is warranted, Step 3 of the process, Baseline Risk Assessment Problem Formulation, is initiated. Step 3 lays the groundwork for conducting a Final ERA (FERA). This document also presents Step 3 of the process since Steps 1 and 2 indicated a need for further investigation.

SERAs are simplified risk assessments that can be conducted with limited data by assuming values for parameters which are lacking. At the screening-level, it is important to minimize the chances of concluding that there is no risk when, in fact, a risk may exist. Therefore, for exposure and toxicity parameters for which site-specific information may be lacking, assumed values should always be biased toward overestimating risk. This ensures that sites that have an ecological risk are further evaluated and provides a defensible conclusion for the elimination of contaminants and exposure pathways based on negligible risk.

The SERA will provide the risk manager with information sufficient to make one of the following three determinations:

1. There is adequate information to conclude that ecological risks are negligible and therefore, there is no need for remedial activities on the basis of ecological risk.

2. The information is not adequate to fully evaluate potential ecological risks and more data are needed before a decision concerning the need for remedial activities can be made. At this point, the next step in the ecological risk assessment process would be to continue on to Steps 4 through 8.

3. Ecological risks determined through Steps 1 and 2 can be managed by implementation of a specified control mechanism (a remedy) and continuation of the ecological risk assessment process would not provide any additional value.

1. SCREENING-LEVEL PROBLEM FORMULATION AND ECOLOGICAL EFFECTS EVALUATION (STEP 1)

1.1 Introduction

The screening-level problem formulation and ecological effects evaluation is part of the initial ecological risk screening assessment. For this initial step, it is likely that site-specific information for determining the nature and extent of contamination and the characterization of ecological receptors is limited. This step includes all the functions of problem formulation (more fully defined in Step 3 of the process) and ecological effects evaluation; however, these functions are performed at a screening-level. The results of this step are used in conjunction with the exposure estimates in the preliminary risk calculation in Step 2.

1.2 Screening-Level Problem Formulation

For the screening-level problem formulation, the SERA develops an understanding of the site based on the environmental setting of the site, suspected contaminants present, the fate and transport mechanisms of these contaminants, mechanisms of ecotoxicity for these chemicals, potential ecological receptors, and exposure pathways. Based on the information gathered to describe these elements, assessment and measurement endpoints are selected as a basis for defining risk.

1.2.1 Enviro nmental Setting and Contaminants at the Site

To begin the screening-level problem formulation, a rudimentary understanding of the environmental setting of the site and potential chemical contamination is required.

1.2.1.1 Environmental Setting

The Brown's Dump Site is the site of a former dumping area located on a 50-acre tract of land north of West 33rd Street and south of Moncrief Creek in the City of Jacksonville, Florida. The geographical coordinates at the center of the site are 30°22'00" north latitude and 81°41'10" west longitude (Figure 1-1). Situated on the site are an elementary school and several single and multi-family residences.

The school is covered by grasses, pavement, three buildings and a parking lot. The parking lot on the eastern portion of the school property is unpaved and ash was observed at the surface. A garden is located between two school buildings. The playground is intended to be grassed; however, the grass is absent or dead in many locations. Bare areas of the playground were covered with topsoil and seeded but the grass has not been re-established in these areas.

A site visit to characterize the site ecology was conducted by Black & Veatch's subcontractor, Khafra, on December 16, 1999. An aerial photograph, presented in Figure 1-2, shows the location of ecological habitats, streams, and other key ecological features observed on the site. The ecological assessment field data sheets completed during the field visit are presented in Appendix C.

There are three areas of potentially viable ecological habitat on the site and an offsite area that could be impacted by site-related contaminants:

- Developed areas associated with the school
- Open field north of the school
- Forested area north and west of the open field
- Moncrief Creek (off-site)

Species of wildlife that are potentially present (or observed) and dominant species of vegetation in these habitat at the site are presented in Table 1-1.

Developed Areas Associated with the School

The majority of the site is developed with buildings, parking areas, lawns, playgrounds, and residences. These areas are heavily impacted by human activity. These areas are shown in Photographs 1 and 2.

Several songbirds were seen and heard during the site investigation in the vicinity of this area. No other wildlife or their sign were observed in the developed areas of the site.

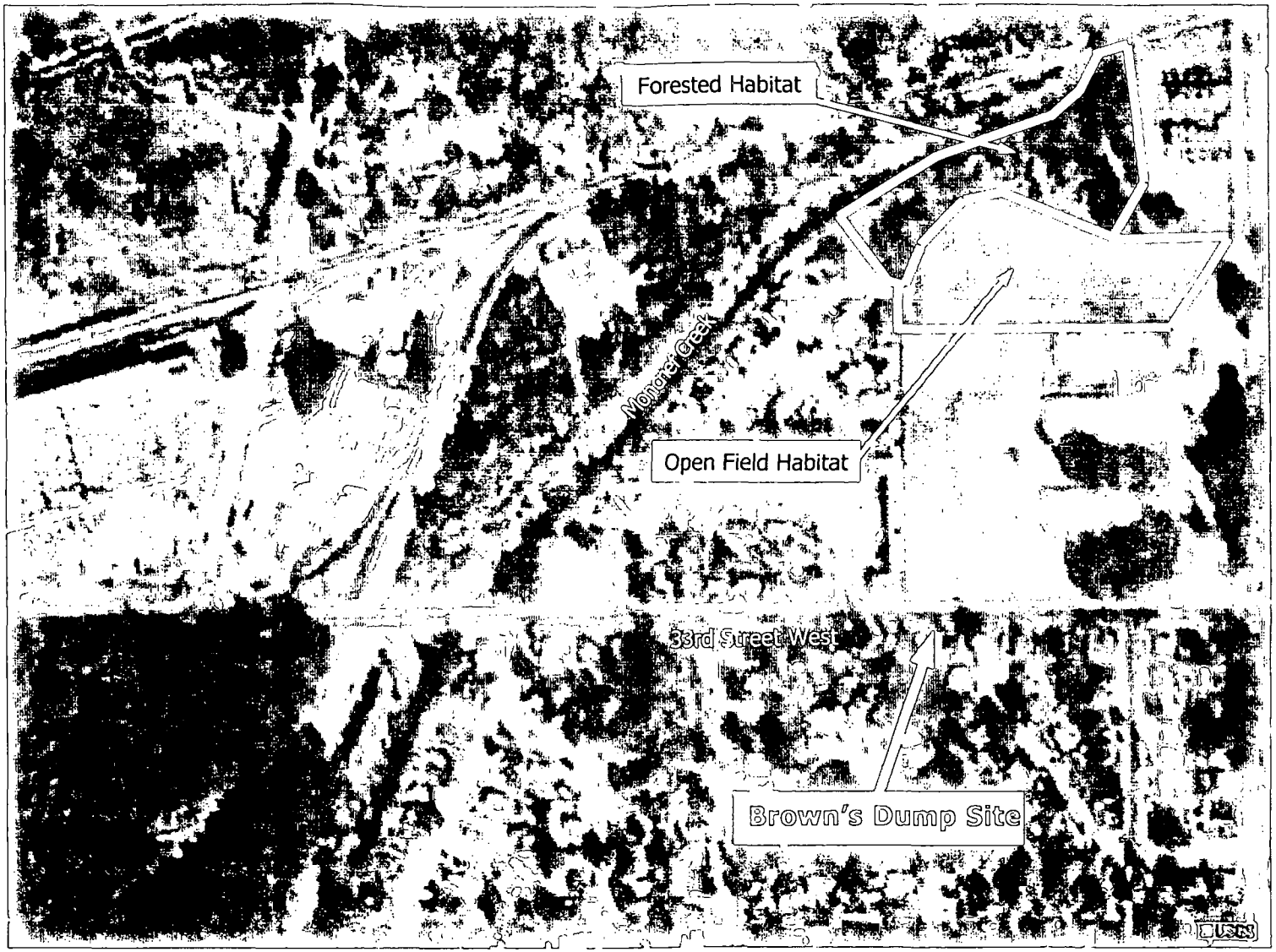
Open Field

The open field area is located north of the elementary school between Pearce Street and the cul-de-sac on Bessie Circle West. This is an area of maintained lawn enclosed within a 6-foot high chain-link fence. While the fence restricts human traffic, dogs and cats observed in this area suggest that wildlife could enter the area. The topography of this portion of the site is generally flat; however, a broad shallow swale runs from east to west across the center of this area and directs surface water runoff through a forested area and into Moncrief Creek. The field and swale are shown in Photograph 3, Appendix A.

During the field investigation, it was also noted that the open field habitats provided little usable habitat for wildlife. This habitat is dominated entirely by maintained lawn grasses and provides no cover or foraging area for wildlife communities. Several songbirds were heard during the site investigation and domestic pets (a dog and a cat) were observed in the open field area. No other wildlife or their sign were observed in the open field area.

Forested Area

A forested area ranging in thickness from 1 to 300 feet was located between the open field and Moncrief Creek. This forested area was dominated by mature trees and a



Screening-Level Ecological Risk Assessment

Brown's Dump Site
Ecological Risk Assessment
City of Jacksonville, Duval County, Florida

Figure 1-2
Aerial Photograph Showing Ecological Habitats

Table 1-1
Wildlife Species Potentially Present or Observed at the Site, by Habitat

Species	Trophic Level	Developed Areas	Open Field	Forested Area	Moncrief Creek
[redacted]nant Vegetatio					
Various grasses	Producer	O	O	O	
Duck potato	Producer				O
Pickerelweed	Producer				O
Saw palmetto	Producer			O	
Longleaf pine	Producer			O	
Myrtle oak	Producer			O	
Spanish moss	Producer			O	
Slash pine	Producer			O	
Various oaks	Producer			O	
Wiregrasses	Producer			O	
Bristly starbur	Producer		O	O	
Partridge pea	Producer		O	O	
Amphibians					
Two-toed Amphiuma	Insectivore/Piscivore				P
Florida Cricket Frog	Insectivore				P
Southern Toad	Insectivore/Piscivore			P	P
Eastern Narrowmouth Toad	Insectivore/Piscivore			P	P
Green Treefrog	Insectivore			P	P
Squirrel Treefrog	Insectivore			P	P
Southern Spring Peeper	Insectivore			P	
Little Grass Frog	Insectivore				P
Upland Chorus Frog	Insectivore				P
Bullfrog	Insectivore/Piscivore				P
Bronze Frog	Insectivore/Piscivore				P
River Frog	Insectivore/Piscivore				P
Southern Leopard Frog	Insectivore/Piscivore				P
Eastern Spadefoot Toad	Insectivore/Piscivore			P	
[redacted]les					
[redacted]n Anole	Insectivore/Carnivore	P	P	P	P
Six-lined Racerunner	Insectivore/Carnivore	P	P	P	
Northern Mole Skink	Insectivore/Carnivore			P	
Southeastern Five-lined Skink	Insectivore/Carnivore			P	P
Broadhead Skink	Insectivore/Carnivore	P	P	P	P
Eastern Slender Glass Lizard	Insectivore/Carnivore	P	P	P	
Southern Fence Lizard	Insectivore/Carnivore			P	
Ground Skink	Insectivore/Carnivore	P	P	P	P
Florida Cottonmouth	Insectivore/Carnivore/Piscivore				P
Southern Racer	Carnivore	P	P	P	
Southern Ringneck Snake	Insectivore/Carnivore/Piscivore			P	P
Corn Snake	Carnivore			P	
Yellow Rat Snake	Carnivore			P	
Kingsnake	Insectivore/Carnivore/Piscivore			P	P
Eastern Coral Snake	Insectivore/Carnivore/Piscivore			P	P
Florida Watersnake	Insectivore/Carnivore/Piscivore				P
Rough Green Snake	Insectivore/Carnivore/Piscivore			P	P
Florida Brown Snake	Insectivore/Carnivore/Piscivore			P	P
Eastern Garter Snake	Insectivore/Carnivore/Piscivore			P	P
Florida Snapping Turtle	Carnivore/Piscivore				P
Florida Mud Turtle	Carnivore/Piscivore				P
Florida Cooter	Carnivore/Piscivore				P
Stinkpot	Carnivore/Piscivore				P
Florida Box Turtle	Carnivore/Piscivore			P	P
Eastern Box Turtle	Carnivore/Piscivore			P	P
American Alligator	Insectivore/Carnivore/Piscivore				P
Birds					
[redacted]ga	Piscivore				P
[redacted] Blue Heron	Piscivore				P

Table 1-1
Wildlife Species Potentially Present or Observed at the Site, by Habitat

Species	Trophic Level	Developed Areas	Open Field	Forested Area	Moncrief Creek
Great Egret	Piscivore				P
Snowy Egret	Piscivore				P
Little Blue Heron	Piscivore				P
Cattle Egret	Insectivore	P	P		
Green Heron	Piscivore				P
Black-crowned Night-Heron	Piscivore				P
Yellow-crowned Night-Heron	Piscivore				P
Black Vulture	Carnivore	P	P	P	
Turkey Vulture	Carnivore	P	P	P	
Osprey	Piscivore				P
Mississippi Kite	Carnivore/piscivore			P	P
Bald Eagle	Piscivore				P
Sharp-shinned Hawk	Carnivore	P	P	P	P
Cooper's Hawk	Carnivore	P	P	P	P
Red-shouldered Hawk	Carnivore	P	P	P	P
Red-tailed Hawk	Carnivore	P	P	P	P
American Kestrel	Carnivore	P	P	P	
Wild Turkey	Insectivore/herbivore			P	
Killdeer	Insectivore	P	P	P	
American Woodcock	Insectivore	P	P	P	
Laughing Gull	Omnivore				P
Ring-billed Gull	Omnivore				P
Herring Gull	Omnivore				P
Caspian Tern	Omnivore				P
Royal Tern	Omnivore				P
Rock Dove	Insectivore/herbivore	P	P	P	
Mourning Dove	Insectivore/herbivore	P	P	P	
Common Ground-Dove	Insectivore/herbivore	P	P	P	
Yellow-billed Cuckoo	Insectivore	P	P	P	
Eastern Screech-Owl	Carnivore	P	P	P	
Barred Owl	Carnivore	P	P	P	
Common Nighthawk	Insectivore	P	P	P	
Belted Kingfisher	Piscivore			P	P
Red-bellied Woodpecker	Insectivore			P	
Yellow-bellied Sapsucker	Insectivore			P	
Downy Woodpecker	Insectivore			P	
Pileated Woodpecker	Insectivore			P	
Eastern Wood-Pewee	Insectivore			P	
Great Crested Flycatcher	Insectivore			P	
Blue Jay	Omnivore	P	P	P	
American Crow	Omnivore	P	P	P	
Fish Crow	Omnivore	P	P	P	P
Carolina Chickadee	Insectivore/herbivore	P	P	P	
Tufted Titmouse	Insectivore/herbivore	P	P	P	
Carolina Wren	Insectivore	P	P	P	
Blue-gray Gnatchatcher	Insectivore	P	P	P	
Eastern Bluebird	Insectivore/herbivore	P	P	P	
American Robin	Insectivore/herbivore	P	P	P	
Gray Catbird	Insectivore/herbivore	P	P	P	
Northern Mockingbird	Insectivore/herbivore	P	P	P	
Brown thrasher	Insectivore/herbivore			P	
European Starling	Insectivore/herbivore	P	P	P	
Loggerhead Shrike	Insectivore/carnivore	P	P	P	
Northern Parula	Insectivore			P	
Yellow-rumped Warbler	Insectivore			P	
Palm Warbler	Insectivore			P	
Ovenbird	Insectivore			P	
Northern Waterthrush	Insectivore			P	P

Table 1-1
Wildlife Species Potentially Present or Observed at the Site, by Habitat

Species	Trophic Level	Developed Areas	Open Field	Forested Area	Moncrief Creek
[redacted]na Waterthrush	Insectivore			P	P
Summer Tanager	Insectivore/herbivore			P	
Northern Cardinal	Insectivore/herbivore			P	
Rufous-sided Towhee	Insectivore/herbivore			P	
Chipping Sparrow	Insectivore/herbivore	P	P	P	
Savannah Sparrow	Insectivore/herbivore	P	P	P	
Song Sparrow	Insectivore/herbivore	P	P	P	
Swamp Sparrow	Insectivore/herbivore				P
White-throated Sparrow	Insectivore/herbivore			P	
White-crowned Sparrow	Insectivore/herbivore	P	P	P	
Red-winged Blackbird	Insectivore				P
Eastern Meadowlark	Insectivore/herbivore	P	P		
Boat-tailed Grackle	Insectivore/herbivore	P	P	P	
Common Grackle	Insectivore/herbivore	P	P	P	
American Goldfinch	Insectivore/herbivore	P	P	P	
House Sparrow	Insectivore/herbivore	P	P	P	
Mammals					
Opossum	Omnivore			P	P
Southeastern Shrew	Insectivore	P	P	P	
Least Shrew	Insectivore	P	P	P	
Shorttail Shrew	Insectivore	P	P	P	
Eastern Mole	Insectivore	P	P		
Raccoon	Omnivore			P	P
River Otter	Piscivore			P	P
Mink	Piscivore			P	P
Striped Skunk	Omnivore			P	
Gray Fox	Omnivore			P	
Bobcat	Carnivore			P	
[redacted]n Gray Squirrel	Herbivore	P	P	P	
S[redacted]ern Flying Squirrel	Herbivore			P	
Eastern Harvest Mouse	Herbivore	P	P	P	
Cotton Mouse	Herbivore	P	P	P	
Hispid Cotton Rat	Herbivore	P	P	P	
Eastern Cottontail	Herbivore	P	P	P	
Whitetail Deer	Herbivore			P	
Fish					
Ladyfish	Insectivore			P	
Mosquitofish	Insectivore			P	
Killifish Species	Insectivore			P	
Bluegill	Insectivore			P	
Inland Silverside	Insectivore			P	
Largemouth Bass	Insectivore/Piscivore			P	
Sailfin Molly	Insectivore			P	
Longnose Gar	Insectivore/Piscivore			P	
Yellow Bullhead	Insectivore/Piscivore			P	
Channel Catfish	Insectivore/Piscivore			P	
Black Crappie	Insectivore			P	
Warmouth	Insectivore			P	
Spotted Sunfish	Insectivore			P	
Redear Sunfish	Insectivore			P	
Redbreast Sunfish	Insectivore			P	
Tilapia Species	Insectivore			P	

O - Observed at site
P - Potentially present at site

[redacted]

dense understory in most areas. Adjacent to the JEA Electrical Substation, a 15-foot area had been cleared of trees and shrubs with the stumps/stems left in place. This area is shown in Photograph 4, Appendix A. The forested area to the west of the open field has a more open understory and also supports an herbaceous community. The broad swale from the open field areas runs through this forested area before cascading

down the bank of Moncrief Creek. This area is shown in Photograph 5, Appendix A. The forested area provides a fairly dense canopy over the section of Moncrief Creek flowing along the northern boundary of the site. The forested area is a relatively small area surrounded entirely by industrial and residential uses and is physically separated from larger areas by roads, railroads, parking lots, and buildings. Several songbirds were heard during the site investigation. No other wildlife or their sign were observed in the open field area.

Moncrief Creek

Moncrief Creek is a non-tidal stream that marks the northern extent of the site and flows from southwest to northeast past the site. On the opposite bank of the creek are railroad tracks of the Seaboard Coastline Railroad, approximately 15 feet up a shrub-covered bank. This Creek has a partial cover of overhanging trees along the southern bank; however, the northern bank, along the railroad, is generally exposed. The banks of this creek are steep, range in height from 5 to 15 feet, and show signs of erosion including scouring and undercutting. Areas at the base of the slope support emergent wetland vegetation. These areas are shown in Photograph 6, Appendix A. The creek is approximately 12 feet wide and has areas of sandy and gravelly substrate under 1 foot of slow-moving water. At the northern boundary of the site the stream exits the site through a large culvert under the railroad tracks. A small pool has formed at the entrance to this culvert. This pool is approximately 2 feet deep. This area is shown in Photograph 7, Appendix A After exiting the site, Moncrief Creek flows 2 miles to the northeast where it discharges into Trout River. From this point, Trout River flows east 2 miles where it discharges into St. John's River.

During the field investigation, it was noted that there was significant streambank erosion, embeddedness of stream sediments, lack of significant overhanging vegetation, and low water flow in Moncrief Creek. Fish and some benthic invertebrates were observed in the stream. Given the relatively short distance between the site and Trout River (2 miles) and the lack of any significant obstructions in the area, anadromous fish could utilize Moncrief Creek during their life cycles. No specific information was available to confirm or rule out this possibility. No other wildlife species were observed using this area.

Threatened and Endangered Species

Threatened or endangered species were not observed during previous site visits. The Florida manatee (*Trichechus manatus*), a state and federally protected endangered species, are known to be present at several locations in the St. John's River, approximately four miles downstream from the site. No records of any other threatened or endangered species were found on or near the site based on an inquiry to the Florida

Natural Areas Inventory (FNAI). Threatened or endangered species that may potentially be present at the site are presented in Table 1-2.

Table 1-2
Potentially Present Species of Threatened or Endangered Wildlife
Brown's Dump Site

Mammals	Birds	Reptiles	Fish
Grey bat Indiana bat Florida manatee Florida panther	Bald eagle Peregrine falcon Florida scrub jay Wood stork Bachman's warbler Kirtland's warbler Ivory-billed woodpecker Red-cockaded woodpecker	American alligator Eastern indigo snake	Shortnose sturgeon

1.2.1.2 Contaminants at the Site

From 1949 to 1953, the site operated as a landfill that accepted ash from the City of Jacksonville municipal solid waste incinerator. When the incinerator was not functioning, the landfill accepted municipal wastes. The site was operated as a hog farm before and after the site was used for dumping until the elementary school was built in 1953. A 2-acre section at the northeast corner of the site was also acquired by the Jacksonville Electric Authority for a substation.

A preliminary assessment (PA) was conducted at the site in 1985 and the PA concluded that further action was necessary. In November 1985, a site screening investigation (SSI) was conducted which included samples of surface and subsurface soil, sediment, groundwater, and surface water. Elevated levels of lead were detected in soil and sediment samples.

USEPA's Technical Assistance Team collected samples of surface soil and surface water in 1995. Elevated levels of lead were detected in these samples. In November of 1995, a Contamination Assessment Report (CAR) was prepared for the City of Jacksonville by EMCON Corporation. The CAR included collection of 62 soil borings, groundwater samples from 8 shallow monitoring wells, and sediment and surface water samples. Based on the CAR, several interim measures were recommended to limit human health risk at the site.

Historical data of ash produced at other incinerator sites indicate the presence of arsenic, mercury, and lead. Inadequate burn temperatures may have also produced dioxins. Waste incinerators typically generate lead, arsenic, dioxins, benzo(a)pyrene, beryllium, and furans.

EPA/START personnel collected 16 surface soil samples, 4 groundwater samples, 4 sediment samples, and 4 surface water samples, including background samples at the site during the week of July 7, 1997. These samples were analyzed for Target Analyte List (TAL) inorganics, and Target Compound List (TCL) organic compounds including volatile organics, semivolatile organics, pesticides, polychlorinated biphenyls (PCBs), dioxins, and furans by an EPA-approved laboratory under the EPA Contract Laboratory Program (CLP). This sampling event was part of an Expanded Site Investigation (ESI).

The findings of this SERA are based solely on the data presented in the ESI. Analytical data results are included in Appendix B of this report. Locations for all of these samples are shown on Figure 1-3.

Surface Soils

Surface soil samples (16) were collected at various locations throughout the site. In general, metals, polynuclear aromatic hydrocarbons (PAHs), pesticides, PCBs, dioxins, and furans were detected in these surface soil samples. The metals, PAHs, dioxins, and furans are expected to be present based on the history of the waste disposed of at the site. Pesticides and PCBs could be from waste materials disposed of at the site or from maintenance activities in the area. Presumptive evidence of lead, 4,4-DDD, beta-BHC, dieldrin, and total hexachlorodibenzodioxin was noted in several surface soil samples. A detailed list of the detected contaminants and concentrations are presented in Table 1-3.

Subsurface Soils

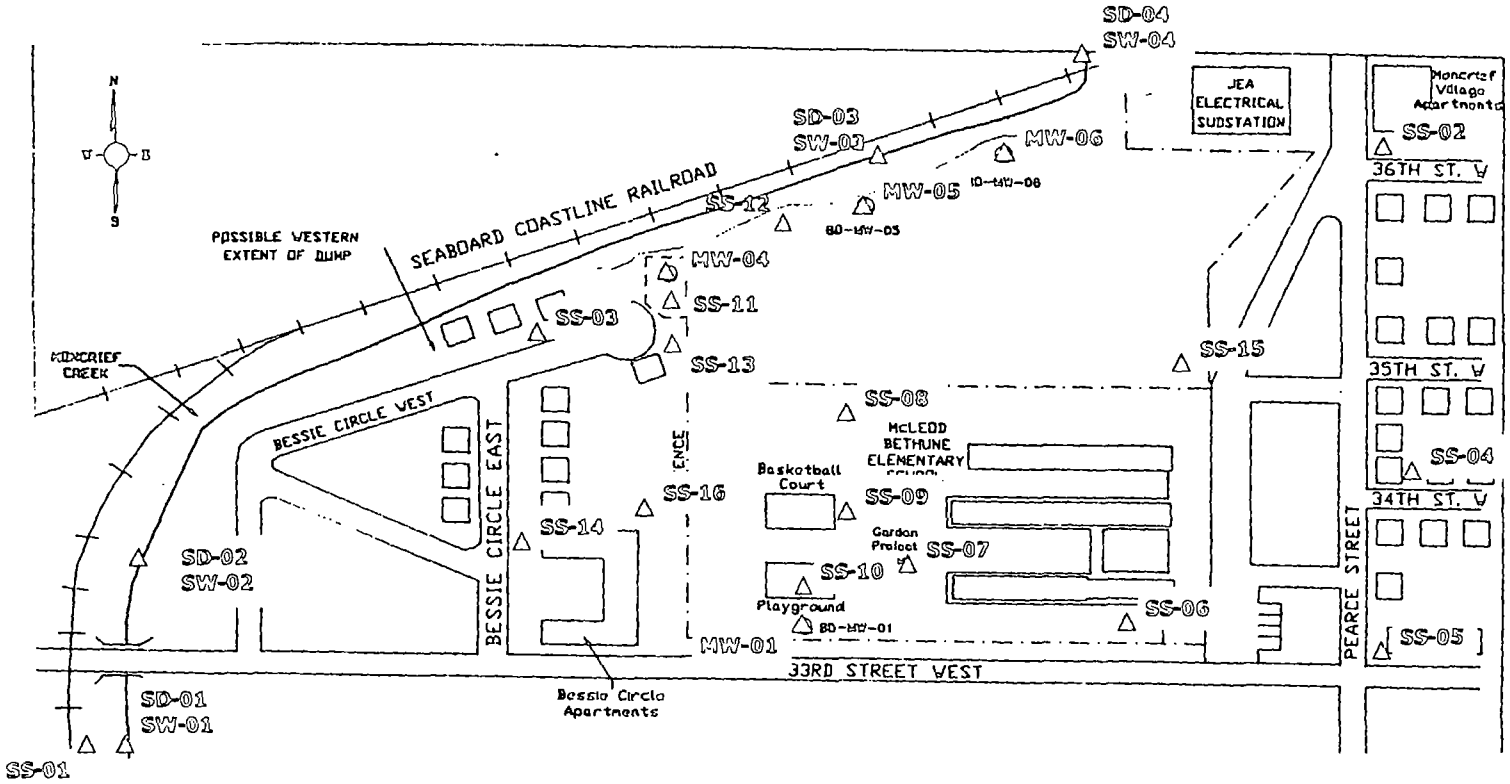
Subsurface soils are those soils deeper than 2 feet. In general, there is little exposure risk for ecological receptors to subsurface soils; however, contamination in subsurface soils can impact groundwater which, in turn, can recharge and contaminate surface waters. Subsurface soils were not collected during the ESI and are not necessary for assessing ecological risks.

Sediment

Sediment samples (4) were collected from the substrate in Moncrief Creek. Sediment samples collected from Moncrief Creek indicated the presence of metals, cyanide, pesticides, and PAHs. The metals and PAHs are expected to be present based on the history of the waste disposed of at the site. Pesticides and cyanide could be from waste materials disposed of at the site as well. Presumptive evidence of lead and dieldrin was noted in two sediment samples. A detailed list of detected contaminants and concentrations from sediments along Moncrief Creek are presented in Table 1-4.

Surface Water

Surface water samples were collected in four locations along Moncrief Creek. Metals were detected in surface water; no organic compounds were detected. Metals are expected to be present based on the history of the waste disposed of at the site. A detailed list of detected contaminants and concentrations from surface water from Moncrief Creek are presented in Table 1-5.



Screening-Level Ecological Risk Assessment

Brown's Dump Site
Ecological Risk Assessment
City of Jacksonville, Duval County, Florida

Figure 1-3
Sample Location Map

Table 1-3
Ecological Screening Values for Contaminants Detected in Surface Soils
Brown Camp Site

Analyte	BDSS-01	BDSS-02	BDSS-03	BDSS-04	BDSS-05	BDSS-06	BDSS-07	BDSS-08	BDSS-09	BDSS-10	BDSS-11 (FA)	BDSS-12 (FA)	BDSS-13 (FA)	BDSS-14	BDSS-15 (OF)	BDSS-16
Inorganics (mg/KG																
Aluminum	1100	2300	2400	1800	1200	830	1300	2100	1100	990	4500	5000	3300	1900	5500	1600
Antimony	ND	11J	2.9J	ND	ND	1.4J	ND	3.3J	ND	2J	21J	19J	32J	6.8J	11J	ND
Arsenic	3J	5.6J	4.1J	2.4J	ND	ND	ND	5.1J	ND	ND	18	35	11	ND	15	ND
Barium	28	160	140	56	24	18	36	110	4.1	10	590	1200	400	84	550	93
Cadmium	ND	2.1	2	1.4	0.45J	0.27J	0.68J	1.9	ND	0.14J	8.8	7.9	5.3	1.1	8.1	1.5
Calcium	5200	4300	13000	4200	2400	1300	630	1200	650	4600	18000	6800	9000	2200	8400	3600
Chromium	3.5J	11J	14J	15J	4.7J	3.8J	6.6J	15J	1.7J	3.7J	58J	79J	140J	11J	57J	15J
Cobalt	0.69J	1.8J	1.9J	0.77J	0.52J	0.5J	0.83J	2.1J	ND	ND	7.5J	14	5J	1J	9.1J	1.5J
Copper	12	83	67	46	40	29	33	120	2.4J	9.9	360	4100	240	38	420	52
Cyanide	ND	0.56	0.74	0.57	ND	ND	1.3	2.8	0.61	ND	1.1	0.68	2.6	ND	14	2.8
Iron	9800J	13000J	8300J	5500J	3500J	4100J	9100J	17000J	420J	1800J	56000	110000J	29000J	8800J	79000J	11000J
Lead	22J	950J	370J	200J	100J	130J	150J	380J	5J	51J	1800JN	9100JN	1900JN	460J	1200JN	180J
Manganese	43J	140J	89	110J	57J	67J	65J	150J	4.7J	22J	470	790J	260J	98J	590J	110J
Magnesium	220J	580J	740J	240J	200J	120J	200J	220J	ND	220J	1700	4900	1100	210	720	340
Mercury (Total)	ND	0.12	0.21	0.17	0.33	ND	ND	0.22	ND	ND	5.6	0.24	0.41	0.24	0.95	0.36
Nickel	1.4J	9.7	8.3J	4.4J	3.7J	5.1J	4.2J	12	ND	2.6J	41	100	24	4J	44	7.2J
Potassium	130J	130J	290J	86J	80J	76J	96J	140J	ND	ND	560	530	320J	150J	210J	160J
Silver	0.37J	0.97J	0.9J	0.45J	0.3J	ND	ND	1.1J	ND	ND	4.3	4.4	2.7	0.47J	4.6	ND
Sodium	75J	34	70	36J	36J	ND	52	35J	46J	30	76	330	86	41J	120	50J
Vanadium	5.4J	8.6J	8.4J	6.7J	4J	6.8J	5.4J	5.2J	1.8J	2.5J	30	16	18	52	21	6.5J
Zinc	37	1700	690	390	130	100	200	630	17	76	3800	2800	2700	230	2200	340
Semi-Volatiles/Extractables (ug/K																
Acenaphthene	ND	ND	ND	ND	ND	ND	ND	ND	ND	500J	ND	ND	ND	ND	49J	ND
Carbazole	ND	50J	ND	ND	ND	ND	48J	ND	ND	810J	ND	ND	ND	ND	110J	ND
Fluorene	ND	ND	ND	ND	ND	ND	ND	ND	ND	470J	ND	ND	ND	ND	ND	ND
Phenanthrene	ND	370	ND	40J	ND	ND	320J	45J	160J	5600J	100J	310J	ND	39J	900	ND
Anthracene	ND	67J	ND	ND	ND	ND	38J	48J	ND	800J	ND	55	ND	ND	71J	ND
Fluoranthene	ND	1200	57J	78J	41J	ND	540	72J	260J	7200J	240J	380	92J	88J	2000	ND
Pyrene	ND	850J	85J	94J	44J	ND	440J	82J	170J	4100J	240J	470J	95J	70J	2000J	ND
Benzo(a)anthracene	ND	540	ND	56J	ND	ND	260J	46J	120J	2100J	180J	250J	ND	ND	690	ND
Chrysene	ND	470	49J	51J	ND	ND	220J	44J	97J	2300J	140J	190J	57J	43J	730	ND
Bis(2-ethylhexyl)pthalate	ND	ND	ND	ND	ND	470J	ND	ND	ND	1200J	ND	ND	ND	ND	500	670
Benzo(b/k)fluoranthene	ND	830J	120J	77J	39J	ND	370J	60J	170J	3500J	270J	290J	110J	87J	1300J	ND
Benzo(a)pyrene	ND	450	64J	41J	ND	ND	210J	ND	83J	1900J	160J	170J	62J	ND	740	ND
Indeno(1,2,3-cd)pyrene	ND	220J	ND	ND	ND	ND	110J	ND	ND	1100J	77J	110J	ND	ND	380J	ND
Dibenzo(a,h)anthracene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	150J	ND
Benzo(g,h,i)perylene	ND	230	57	ND	ND	ND	110	ND	ND	1000	98	120	43	ND	440	ND
Phenol	ND	ND	ND	ND	ND	ND	ND	ND	40	ND	ND	ND	ND	ND	ND	ND
Naphthalene	ND	ND	ND	ND	ND	ND	ND	ND	ND	120	ND	ND	ND	ND	ND	ND
Dibenzofuran	ND	ND	ND	ND	ND	ND	ND	ND	ND	320	ND	ND	ND	ND	ND	ND
Acenapthylene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	47	ND
Pesticides/PCBs (ug/KG																
4,4-DDE	ND	9.4	20	110	ND	ND	ND	ND	ND	ND	270	ND	ND	ND	ND	ND
4,4-DDD	ND	ND	ND	24	ND	ND	ND	ND	ND	ND	41	ND	ND	ND	ND	2.7JN
4,4-DDT	ND	ND	ND	73	ND	ND	ND	ND	ND	ND	99	ND	ND	ND	ND	ND
Alpha-chlordane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	13	ND	ND	ND	ND	ND
beta-BHC	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.81JN
Dieldrin	ND	ND	ND	ND	8.9	1.8J	5.4	ND	ND	ND	ND	2.2J	ND	ND	59	4.4
Endrin	ND	7.9JN	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Endrin Aldehyde	ND	ND	ND	ND	0.87J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Gamma-chlordane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	14	ND	8.4	ND	4	ND
Heptachlor	ND	ND	ND	ND	ND	ND	1.1J	ND	ND	ND	ND	1.6J	ND	ND	ND	0.44
PCB 1254	58	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB 1260	ND	ND	ND	ND	ND	84	280	120	ND	350	500	33J	800	ND	1400	ND
Dioxin/Furan (ng/KG																
Tetrachlorodibenzodioxin (total)	4.8J	9J	57J	4.3J	2.9J	1.4J	9.7J	14J	ND	12J	260J	20J	300J	8.9J	58J	14J
Pentachlorodibenzodioxin (total)	ND	11J	82J	ND	1.3J	ND	9.5J	11J	ND	ND	260J	19J	350J	6.1J	11J	9.1J
Hexachlorodibenzodioxin (total)	15J	150J	580J	140J	49J	21J	28J	150J	ND	ND	2300J	130J	1900JN	63J	290J	100J
Heptachlorodibenzodioxin (total)	33J	580J	2200J	540J	1200J	100J	200J	710J	11J	54J	4600J	350J	6000J	390J	1800J	770J
Octachlorodibenzodioxin	130	1600	7300J	1700	11000J	490	530	2500J	24	170	17000	980	23000	1500	6200	3500J
Tetrachlorodibenzofuran (total)	11J	80J	130J	38J	16J	24J	38J	51J	1.2J	51J	410J	160J	650J	13J	410J	32J
Pentachlorodibenzofuran (total)	3.6J	240J	240J	170J	84J	79J	99J	230J	13J	160J	1100J	210J	1200J	85J	1400J	95J
Hexachlorodibenzofuran (total)	4.6J	220J	130J	110J	48J	36J	49J	89J	5.3J	57J	780J	97J	930J	99J	200J	120J
Heptachlorodibenzofuran (total)	ND	110J	360J	98J	380J	34J	68J	190J	3.5J	ND	810J	61J	1100J	220J	340J	290J
Octachlorodibenzofuran	5J	120	390	100	180	21	40	76	3.1J	9.1J	2800	78	2900	130	360	200

NA - Not available
JN - Presumptive evidence of material, estimated value
ND - Not detected
HQ - Hazard quotient
Shaded cells indicated exceedances of screening values.

3 12 0238

Table 1-3
Ecological Screening Values for Contaminants Detected in Surface Soils
Brown's Dump Site

Analyte	MAX	EPA Region IV Ecological Screening Values for Soil	Hazard Quotient	Further Evaluation?	Rationale
Inorganics (mg/KG					
Aluminum	5500	50	110.0	Yes	HQ > 1
Antimony	32	3.5	9.1	Yes	HQ > 1
Arsenic	35	10	3.5	Yes	HQ > 1
Barium	1200	165	7.3	Yes	HQ > 1
Cadmium	8.8	1.6	5.5	Yes	HQ > 1
Calcium	18000	NA	-	Yes	No screening value available
Chromium	140	0.4	350.0	Yes	HQ > 1
Cobalt	14	20	0.7	No	HQ < 1
Copper	4100	40	102.5	Yes	HQ > 1
Cyanide	14	5	2.8	Yes	HQ > 1
Iron	110000	200	550.0	Yes	HQ > 1
Lead	9100	50	182.0	Yes	HQ > 1
Manganese	790	100	7.9	Yes	HQ > 1
Magnesium	4900	NA	-	Yes	No screening value available
Mercury (Total)	5.6	0.1	56.0	Yes	HQ > 1
Nickel	100	30	3.3	Yes	HQ > 1
Potassium	560	NA	-	Yes	No screening value available
Silver	4.6	2	2.3	Yes	HQ > 1
Sodium	330	NA	-	Yes	No screening value available
Vanadium	52	2	26.0	Yes	HQ > 1
Zinc	3800	50	76.0	Yes	HQ > 1
Semi-Volatiles/Extractables (ug/l					
Acenaphthene	500	20000	0.03	No	HQ < 1
Carbazole	810	NA	-	Yes	No screening value available
Fluorene	470	NA	-	Yes	No screening value available
Phenanthrene	5600	100	56.0	Yes	HQ > 1
Anthracene	800	100	8.0	Yes	HQ > 1
Fluoranthene	7200	100	72.0	Yes	HQ > 1
Pyrene	4100	100	41.0	Yes	HQ > 1
Benzo(a)anthracene	2100	NA	-	Yes	No screening value available
Chrysene	2300	NA	-	Yes	No screening value available
Bis(2-ethylhexyl)pthalate	1200	100	12.0	Yes	HQ > 1
Benzo(b/k)fluoranthene	3500	NA	-	Yes	No screening value available
Benzo(a)pyrene	1900	100	19.0	Yes	HQ > 1
Indeno(1,2,3-cd)pyrene	1100	NA	-	Yes	No screening value available
Dibenzo(a,h)anthracene	150	NA	-	Yes	No screening value available
Benzo(g,h,i)perylene	1000	NA	-	Yes	No screening value available
Phenol	40	50	0.8	No	HQ < 1
Naphthalene	120	100	1.2	Yes	HQ > 1
Dibenzofuran	320	NA	-	Yes	No screening value available
Acenapthylene	47	NA	-	Yes	No screening value available
Pesticides/PCBs (ug/KG					
4,4-DDE	270	2.5	108.0	Yes	HQ > 1
4,4-DDD	41	2.5	16.4	Yes	HQ > 1
4,4-DDT	99	2.5	39.6	Yes	HQ > 1
Alpha-chlordane	13	100	0.1	No	HQ < 1
beta-BHC	0.81	1	0.8	No	Presumptive presence of material below screening value
Dieldrin	59	0.5	118.0	Yes	HQ > 1
Endrin	7.9	1	7.9	Yes	Presumptive presence of material above screening value.
Endrin Aldehyde	0.87	1	0.9	No	HQ < 1
Gamma-chlordane	14	100	0.1	No	HQ < 1
Heptachlor	1.6	100	0.016	No	HQ < 1
PCB 1254	58	20	2.9	Yes	HQ > 1
PCB 1260	1400	20	70.0	Yes	HQ > 1
Dioxin/Furan (ng/KG					
Tetrachlorodibenzodioxin (total)	300	NA	-	Yes	No screening values available but chemical is a known bioaccumulator
Pentachlorodibenzodioxin (total)	350	NA	-	Yes	No screening values available but chemical is a known bioaccumulator
Hexachlorodibenzodioxin (total)	2300	NA	-	Yes	No screening values available but chemical is a known bioaccumulator
Heptachlorodibenzodioxin (total)	6000	NA	-	Yes	No screening values available but chemical is a known bioaccumulator
Octachlorodibenzodioxin	23000	NA	-	Yes	No screening values available but chemical is a known bioaccumulator
Tetrachlorodibenzofuran (total)	650	NA	-	Yes	No screening values available but chemical is a known bioaccumulator
Pentachlorodibenzofuran (total)	1400	NA	-	Yes	No screening values available but chemical is a known bioaccumulator
Hexachlorodibenzofuran (total)	930	NA	-	Yes	No screening values available but chemical is a known bioaccumulator
Heptachlorodibenzofuran (total)	1100	NA	-	Yes	No screening values available but chemical is a known bioaccumulator
Octachlorodibenzofuran	2900	NA	-	Yes	No screening values available but chemical is a known bioaccumulator

NA - Not available
PD - Presumptive evidence of material, estimated value
RD - [redacted]
HQ - [redacted]ient
Shad[redacted]lected exceedances of screening values.

Table 4-4
Ecological Screening Values for Contaminants Detected in Sediment
Brown's Dump Site

Analyte	BDSD-01	BDSD-02	BDSD-03	BDSD-04	MAX	EPA Region IV Ecological Screening Values for Sediment	Hazard Quotient	Further Evaluation?	Rationale
Inorganics (mg/KG									
Aluminum	420	200	730	3300	3300	NA	-	Yes	No screening value available
Antimony	ND	ND	ND	6.8J	6.8	12	0.6	No	HQ < 1
Arsenic	ND	ND	ND	5.8	5.8	7.24	0.8	No	HQ < 1
Barium	5.9	3.9	10	180	180	NA	-	Yes	No screening value available
Cadmium	ND	ND	0.3J	3.7	3.7	1	3.7	Yes	HQ > 1
Calcium	1800	1500	2900	4200	4200	NA	-	Yes	No screening value available
Chromium	2J	2.2J	14J	28J	28	52.3	0.5	No	HQ < 1
Cobalt	ND	ND	ND	4.1J	4.1	NA	-	Yes	No screening value available
Copper	7	9	19.0	190.0	190	18.7	10.2	Yes	HQ > 1
Cyanide	ND	ND	ND	1.4	1.4	NA	-	Yes	No screening value available
Iron	940J	410J	1700J	49000J	49000	NA	-	Yes	No screening value available
Lead	10J	11J	30J	760JN	760	30.2	25.2	Yes	Contaminant detected HQ > 1
Magnesium	ND	ND	190	1100	1100	NA	-	Yes	No screening value available
Manganese	4.9J	4.2J	10J	30J	30	NA	-	Yes	No screening value available
Mercury	ND	ND	ND	0.62	0.62	0.13	4.8	Yes	HQ > 1
Nickel	ND	ND	ND	25	25	15.9	1.6	Yes	HQ > 1
Potassium	ND	ND	170J	330J	330	NA	-	Yes	No screening value available
Silver	ND	ND	ND	1.8J	1.8	2	0.9	No	HQ < 1
Sodium	ND	ND	49J	160J	160	NA	-	Yes	No screening value available
Vanadium	1.6J	1.1J	3J	7.7J	7.7	NA	-	Yes	No screening value available
Zinc	17	17	69	810	810	124	6.5	Yes	HQ > 1
Pesticides/PCBs (ug/KG									
Endosulfan	0.68J	ND	ND	ND	0.68	NA	-	Yes	No screening value available
Gamma-BHC (Lindane)	ND	ND	10	ND	10	3.3	3.0	Yes	HQ > 1
Heptachlor	ND	ND	11	ND	11	NA	-	Yes	No screening value available
Aldrin	ND	ND	9.7	ND	9.7	NA	-	Yes	No screening value available
Dieldrin	0.45JN	ND	9.7	ND	9.7	3.3	2.9	Yes	HQ > 1
Endrin	ND	ND	7.3J	0.96J	7.3	3.3	2.2	Yes	HQ > 1
4,4-DDD	ND	ND	12	ND	12	3.3	3.6	Yes	HQ > 1
Semi-Volatiles/Extractables (ug/K									
Phenanthrene	59J	ND	ND	1200	1200	330	3.6	Yes	HQ > 1
Fluoranthene	300J	ND	ND	2000	2000	330	6.1	Yes	HQ > 1
Benzo(b/k)fluoranthene	170J	ND	ND	780J	780	NA	-	Yes	No screening value available
Benzo(a)anthracene	170J	ND	ND	790	790	330	2.4	Yes	HQ > 1
Benzo(a)pyrene	91J	ND	ND	400J	400	330	1.2	Yes	HQ > 1
Indeno(1,2,3-cd)pyrene	44J	ND	ND	230J	230	NA	-	Yes	No screening value available
Pyrene	240J	ND	ND	1500J	1500	330	4.5	Yes	HQ > 1
Carbazole	ND	ND	ND	100J	100	NA	-	Yes	No screening value available
Anthracene	ND	ND	ND	200J	200	330	0.6	No	HQ < 1
Dibenzo(a,h)anthracene	ND	ND	ND	93J	93	330	0.3	No	HQ < 1
Benzo(g,h,i)perylene	ND	ND	ND	230J	230	NA	-	Yes	No screening value available
Chrysene	150J	ND	ND	680	680	330	2.1	Yes	HQ > 1

JN - Presumptive evidence of material, estimated value.
NA - Not available
ND - Not detected.
HQ - Hazard quotient
Shaded cells indicate that that particular sample exceeded the screening value.

Table 1-5
Ecological Screening Values for Contaminants Detected in Surface Water
Brown's Dump Site

Analyte	BDSW-01	BDSW-02	BDSW-03	BDSW-04	MAX	EPA Region IV Ecological Screening Values for Freshwater Surface Water	Hazard Quotient	Further Evaluation?	Rationale
Inorganics (ug/L									
Aluminum	36	28	70	57	70	87	0.80	No	HQ < 1
Arsenic	16	12	11	ND	16	190	0.08	No	HQ < 1
Barium	43	37	42	50	50	NA	-	Yes	No screening value available
Calcium	53000	45000	50000	54000	54000	NA	-	Yes	No screening value available
Chromium	6J	4J	4J	3J	6	11	0.55	No	HQ < 1
Iron	650J	540	640J	520J	650	1000	0.65	No	HQ < 1
Lead	3	4	ND	3	4	1.32	3.03	Yes	HQ > 1
Magnesium	12000	9900	9200	9000	12000	NA	-	Yes	No screening value available
Manganese	27	25	25	27	27	NA	-	Yes	No screening value available
Potassium	2900J	3100J	3300J	3400J	3400	NA	-	Yes	No screening value available
Sodium	14000	170000	13000	12000	170000	NA	-	Yes	No screening value available
Zinc	24	22	20	100	100	58.91	1.70	Yes	HQ > 1

NA - Not available
ND - Not detected
HQ - Hazard quotient
Shaded cells indicate that that particular sample exceeded the screening value.

Groundwater

Three groundwater wells, located in the forested area adjacent to Moncrief Creek and screened in the surficial aquifer, were sampled. Metals were detected at elevated concentrations in these wells. The metals are expected to be present based on the history of the waste disposed of at the site and are consistent with those contaminants observed in surface soils. A detailed list of detected contaminants and concentrations from groundwater is presented in Table 1-6.

1.2.2 Contaminant Fate and Transport

As shown previously, surface soils and sediment at the site are known to contain elevated levels of metals, cyanide, PAHs, pesticides, PCBs, dioxins, and furan. Surface water and groundwater contained elevated levels of metals. The general fate and transport mechanisms of contaminants in each environmental medium is discussed below.

1.2.2.1 Surface Soils

Contaminants in surface soil can migrate to ecological receptors via several transport processes. These processes include:

- Direct volatilization of contaminant to air
- Lateral movement in rainwater runoff when adsorbed onto suspended sediment
- Lateral movement in wind when adsorbed onto suspended sediment
- Vertical movement via infiltrating rainwater into subsurface soil and groundwater with subsequent re-emergence into surface waters
- Biological uptake, ingestion, and/or bio-transfer

1.2.2.2 Sediment

Contaminants in sediment can migrate to ecological receptors via several transport processes. These processes include:

- Lateral movement downstream with flowing surface water while adsorbed to sediments
- Partitioning to surface water
- Biological uptake, ingestion, and/or bio-transfer

1.2.2.3 Surface Water

Contaminants in surface water can migrate to ecological receptors via several transport processes. These processes include:

- Lateral movement downstream with flowing surface water while adsorbed to suspended materials
- Partitioning to sediment
- Biological uptake, ingestion and/or bio-transfer

Table 1-6
Ecological Screening Values for Contaminants Detected in Groundwater
Brown's Dump Site

Analyte	BDMW-01	BDMW-04	BDMW-05	BDMW-06	MAX	EPA Region IV Ecological Screening Values for Surface Water	Hazard Quotient	Further Evaluation?	Rationale
Inorganics (ug/L									
Aluminum	32	180	370	420	420	87	4.83	Yes	HQ > 1
Arsenic	ND	ND	20	ND	20	190	0.11	No	HQ < 1
Barium	24	75	230	120	230	NA	-	Yes	No screening value available
Cadmium	ND	ND	5	2J	5	0.66	7.58	Yes	HQ > 1
Calcium	2500	38000	87000	79000	87000	NA	-	Yes	No screening value available
Cobalt	ND	ND	7J	ND	7	NA	-	Yes	No screening value available
Copper	ND	17	32	27	32	6.54	4.89	Yes	HQ > 1
Iron	ND	28000J	9300J	12000J	28000	1000	28.00	Yes	HQ > 1
Lead	ND	29	73	64	73	1.32	55.30	Yes	HQ > 1
Magnesium	1200	11000	13000	25000	25000	NA	-	Yes	No screening value available
Manganese	5J	150	2100	75	2100	NA	-	Yes	No screening value available
Nickel	ND	ND	19J	ND	19	87.71	0.22	No	HQ < 1
Potassium	2000J	8400J	16000J	58000J	58000	NA	-	Yes	No screening value available
Sodium	2500	28000	13000	38000	38000	NA	-	Yes	No screening value available
Vanadium	ND	ND	ND	2J	2	NA	-	Yes	No screening value available
Zinc	ND	110	910	330	910	58.91	15.45	Yes	HQ > 1

NA - Not available
ND - Not detected
HQ - Hazard quotient
Shaded cells indicate that that particular sample exceeded the screening value.

1.2.2.4 Groundwater

Depth to groundwater at this site is greater than 2 feet in most locations. Given this depth to groundwater, there is no significant direct exposure potential for ecological receptors. However, it is important to note that groundwater from the site can flow through soils and recharge Moncrief Creek based on known groundwater flow patterns and topography.

1.2.3 Ecotoxicity and Potential Receptors

Understanding the toxic mechanism of a contaminant can help to evaluate the importance of potential exposure pathways and focus the selection of assessment endpoints. Based on the evaluation of contaminant fate and transport conducted previously, ecological receptors could be directly exposed to metals, cyanide, PAHs, pesticides, PCBs, dioxins, and furans directly from surface soils, sediments and surface water or indirectly through food-chain transfer. Contaminants in groundwater may recharge surface waters of the Moncrief Creek, where ecological receptors may be exposed.

1.2.3.1 Ecotoxicity

USEPA Region 4 has developed ecotoxicological screening values for sediment and surface water, which are based on reproductive endpoints with community-wide implications. Groundwater is screened based on the surface water screening values, since the toxicity of groundwater is only realized in the surface water where a receptor would be exposed. In addition, USEPA Region 4 has also developed draft screening levels for surface soils which are based on the most conservative toxicity values for soil organisms, plants, and health-risk studies. The USEPA Region 4 ecotoxicity values for potential contaminants of concern detected at the site are presented in Tables 1-3 through 1-6.

1.2.3.2 Potential Receptors

As stated previously, the developed area, open field and forested habitats located near the school were evaluated to assess their usage and potential to support ecological communities. There is potential aquatic habitat associated with Moncrief Creek, where small fish and some tubificerid worms were observed.

There were no signs of obviously stressed vegetation observed in these areas; however, there were bare areas where vegetation did not grow. The potential causes of the bare areas are presently unknown.

Potential receptors of contaminants in surface soils would include soil organisms, plants, terrestrial wildlife, and predators of these species. Potential receptors of contaminants in sediment would include benthic invertebrates, fishes, and predators of these species. Potential receptors of contaminants in surface water would include fish, other aquatic organisms, and predators of these species. Potential receptors that may be present in the habitats of the site are presented in Table 1-1.

1.2.4 Complete Exposure Pathways

Evaluating potential exposure pathways is one of the primary tasks of the SERA. For an exposure pathway to be complete, a contaminant must be able to travel from the source to ecological receptors and to be taken up by the receptors via one or more exposure routes. If an exposure pathway is not complete for a specific contaminant, that exposure pathway does not require further evaluation. Based on the previous information, there are four potential sources for contamination at the site including:

- Contaminated surface soils in the developed, open field and forested areas of the site
- Contaminated sediments in Moncrief Creek
- Contaminated surface water in Moncrief Creek
- Contaminated groundwater adjacent to Moncrief Creek.

The presence of complete exposure pathways to ecological receptors through direct exposure or food-chain transfer is presented in Table 1-7. For the purposes of the SERA, all potential habitat areas are considered in the development of preliminary complete exposure pathways and assessment endpoints.

1.2.5 Assessment Endpoints

Assessment endpoints are explicit expressions of actual environmental values (e.g., ecological resources) that are to be protected. Valuable ecological resources include those without which ecosystem functions would be significantly impaired. These may include critical resources (e.g., habitat), and those resources perceived as valuable by humans (e.g., endangered species and other issues addressed by legislation). Because assessment endpoints focus on the risk assessment design and analysis, appropriate selection and definition of these endpoints are critical to the utility of a risk assessment.

At the initial-screening stage of the ecological risk assessment process, USEPA Region 4 requires a comparison of the maximum detected concentrations of contaminants to screening-level toxicity data in order to focus subsequent evaluations. The assessment endpoints evaluated by these values are:

- The maintenance of viable aquatic communities/populations in aquatic habitats on the site.
- The maintenance of viable benthic communities/populations in aquatic habitats on the site.
- The maintenance of viable terrestrial communities/populations in terrestrial habitats on the site.

Table 1-7
Preliminary Complete Exposure Pathways
Brown's Dump Site

Source Area	Key Contaminants	Exposure Route	Potential Receptors	Complete Pathway
Surface soils	Metals, PAHs, pesticides, PCBs, dioxins, and furans	Direct exposure	Plants, soil organisms	Yes (all contaminants)
		Food chain exposure (bio-transfer)	Soil insectivores, terrestrial carnivores	Yes (Cd, Hg, Pb, As, pesticides, PCBs, dioxins & furans)
Moncrief Creek Sediments	Metals, cyanide, pesticides, & PAHs	Direct exposure	Aquatic plants & macroinvertebrates	Yes (all contaminants)
		Food chain exposure (bio-transfer)	Probing insectivores & piscivores	Yes (Hg, Pb & pesticides)
Moncrief Creek Surface Water	Metals	Direct exposure	Aquatic plants, fish, & other wildlife	Yes (all contaminants)
		Food chain exposure (bio-transfer)	Piscivores	Yes (Pb)
Groundwater (to surface water)	Metals	Direct exposure	Aquatic plants, fish, & other wildlife	Yes (all contaminants)
		Food chain exposure (bio-transfer)	Piscivores	Yes (Pb)

1.2.6 Preferred Toxicity Data

As stated previously, the assessment endpoints that will be evaluated in the SERA are based on direct exposure routes from surface soil, sediment, and surface water. These assessment endpoints will be measured (measurement endpoints) based on the USEPA Region 4 ecotoxicological screening values for soil, sediment, and surface water. These values are based on reproductive endpoints with community-wide implications. The draft screening levels for surface soils are based on the most conservative toxicity values for soil organisms, plants, and health-risk studies.

1.2.7 Toxicological Uncertainty Assessment

Many contaminants observed at the site do not have Region 4 ecological screening values. These contaminants include essential nutrients as well as other contaminants that have screening values for one or more media or none at all. These essential nutrients that lacked screening values include:

- Calcium
- Magnesium

- Potassium
- Sodium

Other contaminants lacking ecological screening values were detected at the site. The relative importance of these contaminants must be considered when determining the needs for future evaluation at the site. All of these contaminants, broken down into their respective media of concern are presented in Table 1-8:

Table 1-8
Contaminants Detected at the Site That Lack Screening Values
Brown's Dump Site

Surface Soil	Sediment	Surface/Groundwater
Carbazole	Carbazole	Barium
Dibenzofuran	Endosulfan	Cobalt
Fluorene	Heptachlor	Manganese
Benzo(a)anthracene	Aldrin	Vanadium
Chrysene	Benzo(b/k)fluoranthene	
Bis(2-ethylhexyl)phthalate	Indeno(1,2,3-cd)pyrene	
Benzo(b/k)fluoranthene	Benzo(g,h,i)perylene	
Indeno(1,2,3-cd)pyrene	Aluminum	
Dibenzo(a,h)anthracene	Barium	
Benzo(g,h,i)perylene	Cobalt	
Tetrachlorodibenzodioxin (total)	Cyanide	
Pentachlorodibenzodioxin (total)	Iron	
Hexachlorodibenzodioxin (total)	Manganese	
Heptachlorodibenzodioxin (total)	Vanadium	
Octachlorodibenzodioxin (total)		
Tetrachlorodibenzofuran (total)		
Pentachlorodibenzofuran (total)		
Hexachlorodibenzofuran (total)		
Heptachlorodibenzofuran (total)		
Octachlorodibenzofuran (total)		

All of these contaminants are retained for future consideration in Step 2 of the SERA and will be addressed in subsequent discussions of uncertainty.

2. SCREENING-LEVEL EXPOSURE ESTIMATE AND RISK CALCULATION (STEP 2)

2.1 Introduction

This step of the SERA includes estimating the exposure levels and screening for ecological risks. This process will conclude with a scientific-management decision point (SMDP) that makes one of the following determinations:

- Ecological threats are negligible.
- An ecological risk assessment should continue to determine if a risk exists.
- There is a potential for adverse effects and a more detailed risk assessment should be performed.

2.2 Screening-Level Exposure Estimates

To estimate exposures for the SERA, on-site contaminant levels and general information on biological receptors were evaluated where complete exposure pathways exist. For the purposes of the SERA, the highest measured or estimated on-site contaminant concentrations in each medium of concern were considered to be the exposure point concentration. The maximum detected contaminant concentrations in surface soil, sediment, surface water, and groundwater are presented in Tables 1-3 through 1-6.

2.3 Screening Level Risk Calculation

A hazard quotient approach will be used to estimate and express risk for the purposes of this SERA. For each measurement endpoint (surface soil, sediment, and surface water) the hazard quotient (HQ) will be expressed as the ratio of a maximum potential exposure level to the screening criterion:

HQ = Estimated Environmental Concentration/Screening Criterion

A HQ less than one (unity) indicate that the contaminant is unlikely to cause adverse ecological effects. This SERA presents a conservative estimate to ensure that potential ecological effects have not been overlooked. When the results from this estimate do not indicate a potential risk, these calculations can be used to eliminate the negligible risk combinations of contaminants and exposure pathways from future consideration. Risk to each assessment endpoint, based on the HQs of their respective measurement endpoints is discussed below.

2.3.1 The Maintenance of Viable Aquatic Communities/Populations in Aquatic Habitats on the Site.

The maximum surface water concentrations detected in Moncrief Creek were compared to the surface water ecotoxicity screening values (Table 1-5). The maximum

concentrations of concentrations in groundwater were also compared to the surface water ecotoxicity screening values to evaluate the possibility for future impact to this endpoint based on the presence of a complete potential migration pathway (Table 1-6).

This comparison indicates that lead and zinc are present in surface water at levels that could further impact the limited aquatic communities and populations in Moncrief Creek. It is important to note that concentrations of aluminum, cadmium, copper, iron, lead, and zinc are present at concentrations in groundwater that could impact this endpoint if they migrated to surface water at these concentrations.

These metals were detected at levels that present a potential risk to the aquatic communities of Moncrief Creek and are consistent with those contaminants that are potentially present based on the site history and those observed in soil contamination.

In addition, those contaminants detected in surface water (barium, calcium, magnesium, manganese, potassium, and sodium) and in groundwater (barium, calcium, cobalt, magnesium, manganese, potassium, sodium, and vanadium) that lacked screening values should be retained for further evaluation.

2.3.2 The Maintenance of Viable Benthic Communities/Populations in Aquatic Habitats on the Site.

The maximum sediment concentrations detected in Moncrief Creek were compared to the sediment ecotoxicity screening values (Table 1-4). This comparison indicates that maximum detected concentrations of the following contaminants in sediments presents a potential ecological risk to the viability of benthic communities and populations in Moncrief Creek:

- Cadmium
- Copper
- Lead
- Mercury
- Nickel
- Zinc
- Gamma-BHC (Lindane)
- Dieldrin
- Endrin
- 4,4'-DDD
- Phenanthrene
- Fluoranthene
- Pyrene
- Benzo(a)anthracene
- Chrysene
- Benzo(a)pyrene

The metals and PAHs detected in sediment that are at levels which present a potential risk to the benthic communities of Moncrief Creek are consistent with those contaminants at the site based on its history and soil investigations. The pesticides observed in the sediment could be related to unknown wastes disposed of at the site or may be a result of past uses of pesticides within the watershed.

In addition, those contaminants detected in sediment that lacked screening values (see Table 1-8) should be retained for further evaluation.

2.3.3 The Maintenance of Viable Producer, Detritivore, and Soil Microbial Activity as it Relates to Soil Function and Nutrient Cycling.

The maximum surface soil concentrations detected in the open field and forested habitats on the site were compared to the draft surface soil ecotoxicity screening values (Table 1-3). This comparison indicates that maximum detected concentrations of the following contaminants in surface soils present a potential to adversely effect normal soil activity and cycling of nutrients:

- Aluminum
- Antimony
- Arsenic
- Barium
- Cadmium
- Chromium
- Copper
- Cyanide
- Iron
- Lead
- Manganese
- Mercury
- Nickel
- Silver
- Vanadium
- Zinc
- Phenanthrene
- Anthracene
- Fluoranthene
- Pyrene
- Benzo(a)pyrene
- Naphthalene
- Dieldrin
- 4,4'-DDD
- 4,4'-DDE
- 4,4'-DDT
- Endrin
- PCB 1254
- PCB 1260

The metals and PAHs detected in surface soil that are at levels which present a potential risk to the terrestrial communities of the site are consistent with those contaminants at the site based on its history. The PCBs and pesticides observed at the site could be related to unknown wastes disposed of at the site or ongoing maintenance operations at the properties in question.

In addition, those contaminants detected in surface soil that lacked screening values (see Table 1-8) should be retained for further evaluation.

2.4 Scientific/Management Decision Point

Based on the SERA, there are significant potential risks to ecological receptors from contamination of surface soil, sediment, surface water, and groundwater associated with the site.

Surface soil investigations have indicated the presence of metals, PAHs, PCBs, and pesticides at levels that exceed ecological screening criteria and therefore present a potential risk to terrestrial communities. The detected contaminants are consistent with those likely to be in incinerator ash, which was historically disposed of at the site. Therefore, it is a likely conclusion that ecological risks to terrestrial receptors based on metals, PAHs, and pesticides in surface soil are resulting from site-related contaminants historically disposed of at the site. The ability of these on-site habitats to support fully

functional ecological communities will impact the relative importance of these potential risks and are addressed in subsequent discussions of uncertainty.

Investigations of surface water and sediment have indicated the presence of metals, pesticides (in sediment only) and PAHs (in sediment only) that exceed the ecological screening criteria for risks to aquatic and benthic communities. The metals and PAHs that were detected in surface soil are consistent with the operational history of the site. Based on this information it is likely that the on-site contamination is a source of risk to the aquatic habitats of Moncrief Creek.

Based on these factors and the evaluation conducted in Steps 1 and 2 of this process, this ecological risk assessment process should proceed to Step 3.

3. BASELINE RISK ASSESSMENT PROBLEM FORMULATION (STEP 3)

3.1 The Problem Formulation Process

In Step 3, problem formulation establishes the goals, breadth, and focus of the baseline ecological risk assessment (BERA). Through this step, the questions and issues that need to be addressed in the BERA are defined based on potentially complete exposure pathways and ecological effects. The conceptual model of the site developed previously is evaluated to assess data gaps and variables that could better define impacts to the assessment endpoints and the relationships between exposure and effects. Step 3 of the process culminates in a SMDP where the final assessment endpoints, exposure pathways, and conceptual site model questions are agreed upon by all stakeholders.

3.2 Refinement of Preliminary Contaminants of Concern

The SERA identifies those contaminants for which maximum concentrations exceeded screening values. The following are key issues that should be understood in refining the contaminants and pathways of concern in the ecological risk assessment process:

1. Contaminants with low potential for toxicological effects such as the essential nutrients (calcium, magnesium, sodium, and potassium) probably do not present significant ecological risk and should not drive future investigations on the site since they are not overtly related to suspected source contaminants.

2. The distribution of contamination relative to the location of the suspected source areas and potential ecological habitats should be considered.

3.2.1 Essential Nutrients

Several of the identified contaminants are essential nutrients and are bioregulated by most organisms. As a result, ecological toxicity data for these nutrients (calcium, magnesium, sodium, and potassium) are lacking due to a general lack of significant concern. Based on this information and the lack of a suspected source of these contaminants, these compounds should not be further evaluated in future ecological evaluations.

3.2.2 Sample Distributio n

There were three key ecological habitats observed on or near the site which include the two terrestrial habitats (open field and forested area) and one aquatic habitat (Moncrief Creek).

3.2.2.1 Terrestrial Habitat Soil Sampling

Twelve surface soil samples (SS-02 through SS-10, SS-14, and SS-16) were collected in the residential, playground, and developed areas of the site. Only one surface soil

sample (SS-15) would be representative of the open field habitat. Three surface soil samples (SS-11, SS-12, and SS-13) would be representative of the forested habitat.

The surface soil sample collected in the developed and open field habitat contained metals (including bioaccumulative metals), cyanide, PAHs, pesticides, and PCBs at levels that were significantly over ecological screening values. Maximum site-wide concentrations of aluminum, cyanide, silver, dieldrin and PCB 1260 were detected in the open field habitat. Lead was also detected in the open field at concentrations approximately two orders of magnitude higher than the screening values; however, the accuracy of this data is questionable based on a "JN" laboratory qualifiers. The "JN" qualifier for lead indicates that the laboratory reported an estimated concentration based on presumptive evidence that this inorganic compound was present in the sample. This type of qualifier is very unusual for inorganic compounds and may suggest a problem in the laboratory analysis.

The surface soil samples collected in the forested habitat contained metals (including bioaccumulative metals), PAHs, pesticides, and PCBs at levels that were significantly over ecological screening values. Maximum site-wide concentrations of antimony, arsenic, barium, cadmium, chromium, copper, iron, lead, mercury, nickel, zinc, DDD, DDE, and DDT were detected in this area. The detected lead was present at concentrations almost three orders of magnitude higher than the screening values; however, the accuracy of this data is questionable based on a "JN" laboratory qualifiers. The "JN" qualifier for lead indicates that the laboratory reported an estimated concentration based on presumptive evidence that this inorganic compound was present in the sample. This type of qualifier is very unusual for inorganic compounds and may suggest a problem in the laboratory analysis.

3.2.2.2 Aquatic Habitat Sampling

Surface water and sediment samples were collected from the aquatic habitats of Moncrief Creek; however, information describing the substrate and the microhabitat of the stream where the samples were collected were not available. Based on this lack of detail, all sediment and surface water samples were considered to be representative of all aquatic habitats in Moncrief Creek.

Sediment samples SD-01 and SD-02 did not contain contamination at levels exceeding ecological screening values. Detected levels of five pesticides and copper exceeding ecological levels were associated with sample SD-03, located just downstream of the site. The highest levels of pesticides were observed in this sample. Cadmium, copper, lead, mercury, nickel, zinc, and PAHs were detected at concentrations exceeding ecological screening levels in SD-04. SD-04 had the highest concentrations of all detected metals and PAHs. It is important to note that pesticides were not detected above ecological screening values in SD-04. The lead detected in SD-04 was present at a concentration significantly exceeding its screening value; however, the accuracy of this result is questionable based on a "JN" laboratory qualifier indicating that the laboratory reported an estimated concentration based on presumptive evidence that this inorganic compound was present in the sample. This type of qualifier is very unusual for inorganic compounds and may suggest a problem in the laboratory analysis.

In surface water, lead was present in all samples (except SW-03) at consistent concentrations that exceeded ecological screening levels. Zinc was only present in one downstream sample (SW-04) at concentrations exceeding the ecological screening values. Lead and zinc were also present in groundwater samples collected immediately adjacent to and upgradient of the stream (MW-04, MW-05, and MW-06) at levels exceeding ecological screening criteria. This could indicate that groundwater may represent a continuing source of contamination to Moncrief Creek. Groundwater also contained significant levels of aluminum, cadmium, copper, and iron that could present a risk to aquatic receptors in Moncrief Creek; however, these contaminants were not observed in surface water at significant concentrations.

3.3 Literature Search on Known Ecological Effects

The screening-level values used in the SERA are based on direct exposures and may not be representative of food-chain exposures. Potential sources of ecological effects data are discussed for direct exposures and food-chain exposures are discussed below. Given the large number of potential contaminants of concern, individual ecological effects data was not developed for each contaminant, instead, annotated bibliographies and other sources of this data are provided.

Individual studies of the ecological effects of direct exposures to contaminants in surface soils are cited in "*Toxicological Benchmarks for Screening Contaminants of Potential Concern for Effects on Terrestrial Plants, 1997 Revision*" prepared by Lockheed Martin Energy Systems, Inc. for the U.S. Department of Energy (Efroymson et al. 1997a) and "*Toxicological Benchmarks for Screening Contaminants of Potential Concern for Effects on Soil and Litter Invertebrates and Heterotrophic Processes, 1997 Revision*" prepared by Lockheed Martin Energy Systems, Inc. for the U.S. Department of Energy (Efroymson et al. 1997b).

Studies of sediment toxicity to benthic invertebrates via direct exposure in freshwater systems are available from several sources including those used in the USEPA Region 4 sediment screening values. An alternate source of sediment toxicity data that may be applicable to the site would be the Ontario (Canada) Ministry of the Environment (OMOE) sediment toxicity values developed by Persaud et al. (1996) for sediments in the Great Lakes system.

The food-chain exposure ecological effects should be determined by a comparison of estimated exposure doses to effects that could have ecosystem-wide implications (such as reproductive effects). Individual studies of ecological effects for many contaminants are cited in "*Toxicological Benchmarks for Wildlife, 1996 Revision*" prepared by Lockheed Martin Energy Systems, Inc. for the U.S. Department of Energy (Sample et al. 1996).

3.4 Contaminant Fate and Transport, Ecosystems Potentially at Risk, and Complete Exposure Pathways

In this step, the exposure pathways and ecosystems associated with the site are evaluated in more detail. In many cases this may require the collection of additional

information on the fate and transport properties of the contaminants of concern, th ecological setting and ecosystems at risk, and the magnitude, extent, spatial, and temporal variability of contamination relative to the proposed assessment endpoints.

3.4.1 Contaminant Fate and Transport

The fate and transport of all key ecological contaminants of concern as described during the refinement process is discussed below. This information is presented for each of the key contaminant groups.

3.4.1.1 PAHs

Within the group of chemicals identified as PAHs, the fate and transport mechanisms are generally similar. Volatilization of these chemicals from soils has been demonstrated to be substantial and may account for over 20 percent of the loss of contaminant from surface soils (ATSDR 1993-1998). PAHs have moderately high K_{oc} values ranging from 10^3 to 10^4 indicating that they tend to strongly adsorb to organic material in soil and sediment. In soils and sediment with a low organic material content, PAHs have been shown to move into groundwater and migrate both laterally and vertically (ATSDR 1993a). Invertebrates and crustaceans readily assimilate these PAHs from sediment and water; however, mollusks, polychaete worms and most vertebrates can effectively metabolize and eliminate these compounds. As a result of these processes, biomagnification of these chemicals is not significant with respect to predatory terrestrial or aquatic wildlife; however, bioaccumulation of PAHs may be significant in benthic invertebrates and soil invertebrates.

3.4.1.2 Pesticides, PCBs, Dioxins and Furans

Within the group of compounds identified as pesticides, PCBs, dioxins, and furans, the fate and transport mechanisms are very similar (ATSDR 1993-1998). These chemicals are large, complex chlorinated organic molecules that tend to have limited potential for atmospheric volatilization from soils due to their low very low vapor pressures. Pesticides, PCBs, dioxins, and furans have very high K_{oc} values indicating that they tend to strongly adsorb to organic material in soil and sediment. As a result, these compounds are usually found in sediments and not in the surface waters of aquatic systems. These compounds are also not very mobile in groundwater; therefore, groundwater migration is not a significant migration pathway. Due to their high K_{ow} values, these compounds are lipophilic and are easily absorbed in lipid tissue in plants and animals. These chemicals tend to bioconcentrate in aquatic organisms, especially at the level of invertebrates and aquatic organisms that ingest sediments. Some of these compounds (PCBs and some pesticides) may significantly biomagnify with increasing trophic level; however, all of these compounds are known to undergo bio-transfer to some degree. In the terrestrial system, these compounds are not likely to be taken up by plants due to their low solubility and high soil affinity; however, underground roots may contain significant concentrations. Bio-transfer in terrestrial systems was also observed and indicates a potential for biomagnification of these compounds.

3.4.1.3 Metals

The fate and transport properties of metals are highly variable (ATSDR 1993-1998). One metal, mercury, may be slightly volatile at normal atmospheric conditions; although this is usually insignificant, while all other metals are non-volatile. Metal adsorption to soils is very complex and is related to physical and chemical properties of the soils themselves. Some metals are strongly adsorbed to inorganic materials while others adsorb to organic matter. Some metals do not adsorb to soils at all while others do so significantly. The tendency to adsorb to soils dramatically affects the movement of metals from surface soils downward into subsurface soil/groundwater and offsite carried in runoff. Of all the metals detected in surface soils, only mercury, cadmium, and selenium have been shown to move through bioaccumulation and may biomagnify significantly in both terrestrial and aquatic food-chains. Lead and arsenic may bioaccumulate in terrestrial organisms; however, they do not typically biomagnify in food chains.

3.4.1.4 Cyanide

Volatilization and biodegradation are the most significant removal processes for cyanide in soils. Cyanide has a low soil sorption capability and is not usually mobile in groundwater because of fixation by trace minerals through complexation or transformation by soil organisms. Metal cyanides and hydrogen cyanide do not bioconcentrate in aquatic organisms and there is no evidence suggesting cyanide biomagnifies in the food chain (ATSDR 1993-1998).

3.4.2 Ecosystems Potentially at Risk

Based on the data evaluated for the site and field observations, the three terrestrial (developed, open field and forested) habitats and the one aquatic habitat (Moncrief Creek) are at potential risk. Contaminants suspected to be present in the incinerator ash, specifically metals and PAHs, have been detected at elevations exceeding ecological screening values in each of these habitats. Several metals, pesticides, and PAHs detected at concentrations exceeding ecological screening levels are known to bioaccumulate. These metals and pesticides biomagnify in terrestrial food chains.

3.4.3 Complete Exposure Pathways

The complete exposure pathways identified in the SERA (Section 1.2.4) were re-evaluated based on the problem formulation of Step 3. This re-evaluation does not result in the elimination of any exposure pathway; however, it does further focus subsequent ecological activities on those key contaminants of ecological concern. The exposure pathways considered in the Problem Formulation are presented in Table 3-1.

3.5 Selection of Assessment Endpoints

An assessment endpoint is an explicit expression of the environmental value that is to be protected. Ecological risk assessments involve multiple species that are to be exposed to different degrees and respond differently to the same contaminant. However, it is not practical or possible to directly evaluate risks to every component of the ecosystem.

Table 3-1
Final Complete Exposure Pathways
Brown's Dump Site

Habitat and Media	Key Contaminants	Exposure Route	Potential Receptors	Complete Pathway
Developed Area Surface Soils	Metals, cyanide, PAHs, pesticides, PCBs, dioxins, and furans	Direct exposure	Plants, soil organisms	Yes (all contaminants)
		Food chain exposure (bio-transfer)	Soil insectivores, terrestrial carnivores	Yes (Cd, Hg, Pb, As, pesticides, PCBs, dioxins & furans)
Open Field Surface Soils	Metals, cyanide, PAHs, pesticides, PCBs, dioxins, and furans	Direct exposure	Plants, soil organisms	Yes (all contaminants)
		Food chain exposure (bio-transfer)	Soil insectivores, terrestrial carnivores	Yes (Cd, Hg, Pb, As, pesticides, PCBs, dioxins & furans)
Forested Surface Soils	Metals, PAHs, pesticides, PCBs, dioxins, and furans	Direct exposure	Plants, soil organisms	Yes (all contaminants)
		Food chain exposure (bio-transfer)	Soil insectivores, terrestrial carnivores	Yes (Cd, Hg, Pb, As, pesticides, PCBs, dioxins & furans)
Moncrief Creek Sediments	Metals, cyanide, pesticides, & PAHs	Direct exposure	Aquatic plants & macroinvertebrates	Yes (all contaminants)
		Food chain exposure (bio-transfer)	Probing insectivores & piscivores	Yes (Hg, Pb, & pesticides)
Moncrief Creek Surface Water	Metals	Direct exposure	Aquatic plants, fish, & other wildlife	Yes (all contaminants)
		Food chain exposure (bio-transfer)	Piscivores	Yes (Pb)
Groundwater (to surface water)	Metals	Direct exposure	Aquatic plants, fish, & other wildlife	Yes (all contaminants)
		Food chain exposure (bio-transfer)	Piscivores	Yes (Pb)

Instead, assessment endpoints focus the risk assessment on particular components of the ecosystem that could be adversely affected by contaminants at the site. Based on the SERA and refinement of contaminants in this Problem Formulation, we recommend the following seven assessment endpoints are recommended for this ecological risk assessment:

- The maintenance of viable aquatic communities/populations in aquatic habitats on the site.
- The maintenance of viable benthic communities/populations in aquatic habitats on the site.
- The maintenance of viable producer, detritivore, and soil microbial activity as it relates to soil function and nutrient cycling.
- The maintenance of viable terrestrial insectivore communities in the region based on bio-transfer of arsenic, cadmium, mercury, lead, pesticides, PCBs, dioxins & furans in surface soils.
- The maintenance of viable terrestrial carnivore communities in the region based on bio-transfer of arsenic, cadmium, mercury, lead, pesticides, PCBs, dioxins & furans in surface soils.
- The maintenance of aquatic insectivore communities in the region based on bio-transfer of mercury, lead, and pesticides in sediments and surface water.
- The maintenance of piscivore communities in the region based on bio-transfer of mercury, lead, and pesticides in sediments and surface water.

3.6 The Conceptual Model and Risk Questions

The conceptual model establishes the complete exposure pathways that will be evaluated in the ecological risk assessment and the relationship of the measurement endpoints to the assessment endpoints. The risk questions are presented to guide future evaluations at the site.

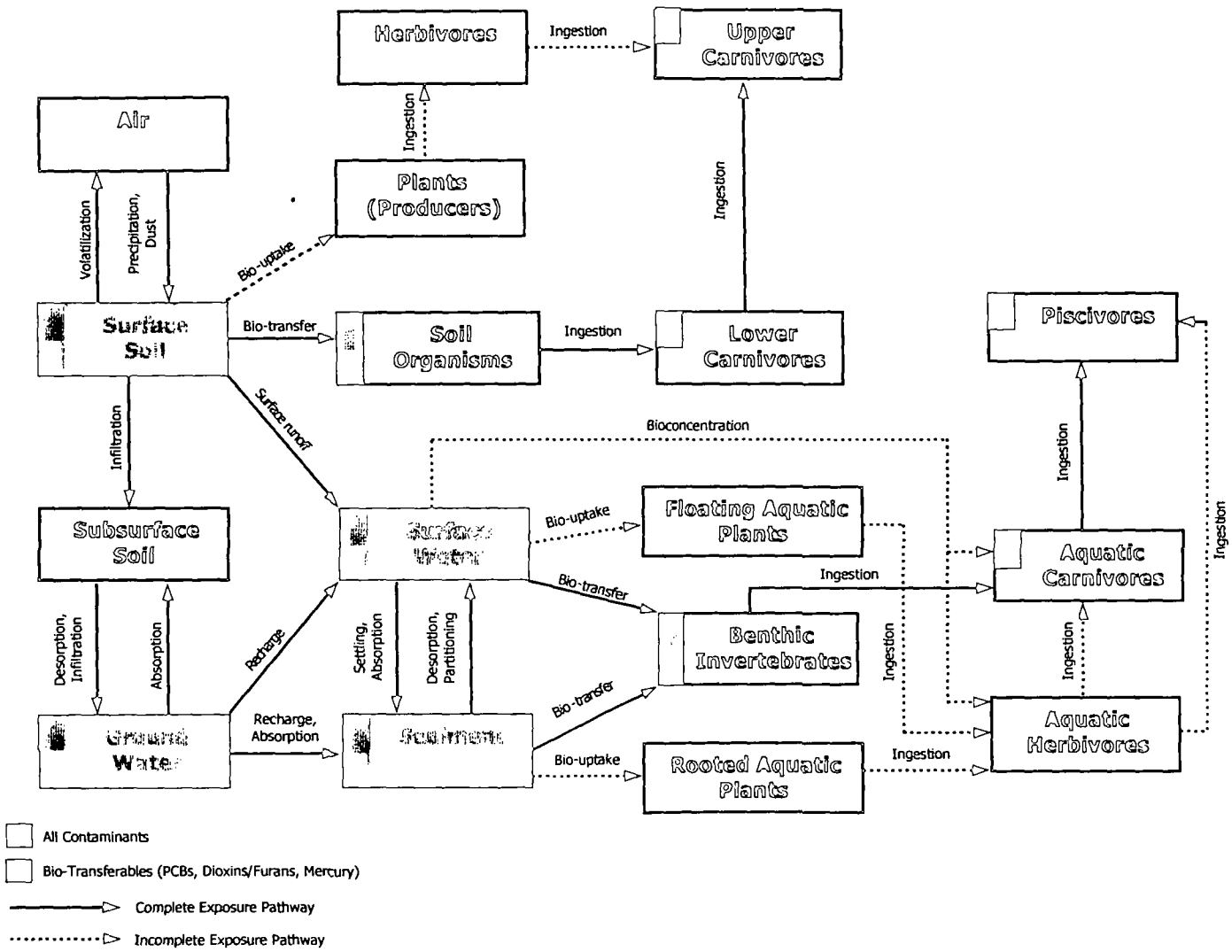
3.6.1 Conceptual Model

Based on all the previous information obtained, an integrated conceptual model is developed that includes a contaminant fate and transport diagram tracing the movement of contaminants from sources, through the ecosystem, to receptors that include the assessment endpoint. Contaminant exposure pathways that do not lead to a species or group of species associated with the proposed assessment endpoint indicate an incomplete pathway or a need for additional data. In addition, this conceptual model also indicates areas where additional data would be helpful. The conceptual model developed for this site is presented in Figure 3-1.

3.6.2 Risk Questions and Uncertainty

The risk questions and uncertainty are presented to understand the relationships of proposed assessment endpoints to the predicted responses when exposed to contaminants. These questions provide the basis for developing the study design (Step 4) and for evaluating the results of the site investigation (Step 6) and risk characterization (Step 7). The risk questions generally pose the question:

"Does (or could) each contaminant of concern cause adverse effects on the assessment endpoint?"



Screening-Level Ecological Risk Assessment

Brown's Dump Site
Ecological Risk Assessment
City of Jacksonville, Duval County, Florida

Figure 3-1
Ecological Conceptual Exposure Model

Answering this question for each assessment endpoint will focus subsequent investigations on particular exposure pathways, variables, data gaps, and uncertainty that are most significant in determining the actual risks at the site.

Assessment Endpoint No. 1: The maintenance of viable aquatic communities and populations in aquatic habitats on the site.

Surface water analytical data collected from Moncrief Creek indicate lead and zinc are at levels that exceed USEPA Region 4 ecological screening values. In addition, barium and manganese were also detected; however, there were no screening values for these metals. Groundwater analytical data collected adjacent to Moncrief Creek also indicated concentrations of lead and zinc above ecological screening levels. Based in this information, groundwater at the site may represent a continuing source of contamination to Moncrief Creek.

There are some key areas of uncertainty that can be considered when developing workplans to further investigate ecological risks to this endpoint:

- Based on existing information, it cannot be determined if risks to this endpoint are site-related. Additional work to define the background water quality of Moncrief Creek in areas upgradient of the subject site may be required to determine if risks to Moncrief Creek are site-related.

- The conclusion that there are potential risks to this endpoint are based on contamination observed in three widely spaced samples (only one of which is downgradient of known areas of waste disposal). These samples may not represent worst case conditions (in groundwater recharge areas) or may not have been collected in areas where fine-grained sediments have been deposited (where contaminant concentrations would be highest). Based on the potential risks and this uncertainty, additional surface water sampling may be required in areas where groundwater concentrations were high and in depositional areas.

- The calculated hazard quotients for this endpoint are relatively low (lead = 1.7, zinc = 3.0). Based on these low HQs, it is recommended that this endpoint be considered in light of the risks calculated for sediment data and the Moncrief Creek habitat as a whole before selecting an appropriate remedial action.

Assessment Endpoint No. 2: The maintenance of viable benthic communities and populations in aquatic habitats on the site.

Sediment analytical data collected from Moncrief Creek indicates metals, pesticides, and PAHs are at concentrations that exceed USEPA Region 4 ecological screening values. Nearby surface soil data also detected concentrations of the same contaminants at ecologically significant levels.

There are some key areas of uncertainty that can be considered when developing workplans to further investigate ecological risks to this endpoint:

- Based on existing information, it cannot be determined if risks to this endpoint are site-related. Additional work to define the background sediment quality of Moncrief Creek in areas upgradient of the subject site may be required to determine if risks to Moncrief Creek are site-related.

- Historical file information has indicated that the sediment in Moncrief Creek was periodically dredged as recently as December 1999. Data collected during the ESI to characterize sediments may not be representative of current conditions since dredging has been known to occur between the ESI in 1997 and December 1999. Additional sediment samples should be collected to determine if a potential risk still exists.

- The conclusion that there are potential risks to this endpoint are based on contamination observed in two widely spaced samples. There is some evidence that sediment samples collected from Moncrief Creek were not located in depositional areas. As a result, the sediment samples may not be biased toward those depositional areas that could contain the highest contaminant concentrations. Based on the potential risks and this uncertainty, additional sediment sampling may be required in depositional areas.

- Lead in sample SD-04 was reported with "JN" qualifiers in the data package. The "JN" qualifier for lead in this sample indicates that the laboratory reported an estimated concentration based on presumptive evidence that this inorganic compound was present in the sample. This type of qualifier is very unusual for inorganic compounds and may suggest a problem in the laboratory analysis. The "JN"-qualified data for lead was an order of magnitude higher than the maximum unqualified data point and drives the risk for lead to this endpoint.

- Dieldrin in sample SD-01 was reported with "JN" qualifiers in the data package indicating that the estimated concentration reported was based on presumptive evidence of the contaminant. The "JN"-qualified data for dieldrin was collected in a sample collected in an area of known ash disposal. The estimated concentration of this contaminant was below both the maximum unqualified data point and the ecological screening value; therefore, this data uncertainty does not affect the conclusions of the SERA.

- The calculated hazard quotients are below 10 for all contaminants detected in sediment with the exception of lead (HQ=25.2) and copper (HQ = 10.2). Based on these low HQs, it is recommended that this endpoint be considered in light of the risks calculated for surface water data and the Moncrief Creek habitat as a whole before selecting an appropriate remedial action.

Assessment Endpoint No. 3: The maintenance of viable producer, detritivore, and soil microbial activity as it relates to soil function and nutrient cycling.

Surface soil data was collected from the terrestrial ecological habitats on the site. This data indicates that metals, cyanide (open field only), PAHs, pesticides, PCBs, are present at concentrations that exceed USEPA Region 4 ecological screening values. Dioxins and

furans were present at high concentrations throughout both terrestrial habitats; however, due to the absence of ecological screening values for these contaminants, their associated ecological risks to this endpoint are unknown.

There are some key areas of uncertainty that can be considered when developing workplans to further investigate ecological risks to this endpoint:

- Historical file information has indicated that the some areas of surface soils containing high contaminant levels have been excavated and removed since the ESI sampling was completed in 1997. These contaminated materials were removed from the site and disposed of as hazardous waste. The excavated areas have been backfilled with topsoil and trees were planted. As a result, data collected during the ESI to characterize surface soils in this area may not be representative of current conditions. Additional surface soil samples should be collected to determine if a potential risk still exists.

- The conclusion that there are potential risks to this endpoint for two of the terrestrial habitats (open field and forested areas) is based on an extremely limited data set. Only one surface soil sample was collected in the open field area (SS-15) and three soil samples were collected in the same general area within the forested area (SS-11, SS-12, and SS-13). Historical file information indicates that ash was disposed of throughout areas that include the two terrestrial habitats. In addition, dredged material from Moncrief Creek is suspected to have been disposed of along its banks in areas that would include the forested habitat. Based on this information, additional surface soil sampling in these two terrestrial habitats may be required to define the nature and extent of ecological risk to this endpoint.

- The lead detected in soil samples from the open field and forested habitats was reported with "JN" qualifiers in the data package. The "JN" qualifier for lead indicates that the laboratory reported an estimated concentration based on presumptive evidence that this inorganic compound was present in the sample. This type of qualifier is very unusual for inorganic compounds and may suggest a problem in the laboratory analysis. The "JN"-qualified data for lead was an order of magnitude higher than the maximum unqualified data point; however, both values were above the ecological screening criteria.

- Dioxins and furans were detected at high concentrations throughout the two terrestrial habitats. These contaminants are known to have toxic effects on ecological receptors; however, they have no corresponding ecological screening levels. An evaluation of the effects of these contaminants on this endpoint could require testing of the toxicity of site soils to these types of organisms; however, the evaluation of food-chain exposure for these contaminants for other endpoints can address the terrestrial risks.

Assessment Endpoint No. 4: The maintenance of viable terrestrial insectivore communities in the region based on bio-transfer of arsenic, cadmium, mercury, lead, pesticides, PCBs, dioxins and furans in surface soils.

Hazard quotients for these contaminants of concern were not calculated since USEPA Region 4 does not require dose-exposure modeling in the first two steps of the ecological risk assessment process; however, these bioaccumulative contaminants were detected above ecological screening values.

There are some key areas of uncertainty that can be considered when developing workplans to further investigate of ecological risks to this endpoint:

- Historical file information has indicated that the some areas of surface soils containing high contaminant levels have been excavated and removed since the ESI sampling was completed in 1997. These contaminated materials were removed from the site and disposed of as hazardous waste. The excavated areas have been backfilled with topsoil and trees were planted. As a result, data collected during the ESI to characterize surface soils in this area may not be representative of current conditions. This may require the acquisition of additional surface soil samples in this area to determine if a potential risk still exists.

- The lead detected in soil samples from the open field and forested habitats was reported with "JN" qualifiers in the data package. The "JN" qualifier for lead indicates that the laboratory reported an estimated concentration based on presumptive evidence that this inorganic compound was present in the sample. This type of qualifier is very unusual for inorganic compounds and may suggest a problem in the laboratory analysis. The "JN"-qualified data for lead was an order of magnitude higher than the maximum unqualified data point; however, both values were above the ecological screening criteria.

- The SERA considered the maximum detected concentrations of each contaminant in each of the evaluated media. The dose and exposure calculations required to evaluate this assessment endpoint should be based on a representative exposure point concentration. The exposure point concentration should consider the life histories of the respective receptor organisms and may require the use of a site-wide average, a habitat-biased average, the 95 percent upper confidence limit, or other methods of establishing realistic exposure point concentrations. Thorough assessment of this endpoint may also require additional data to measure or estimate concentrations of contaminants in common food items such as earthworms and/or insects.

- The ability to accurately estimate realistic exposure point concentrations is adversely effected by the small data set available for two of the terrestrial habitats. Only one surface soil sample was collected in the open field area (SS-15) and three soil samples were collected in the same general area within the forested area (SS-11, SS-12, and SS-13). Historical file information indicates that ash was disposed of throughout areas that include the two terrestrial habitats. In addition, dredged material from Moncrief Creek is suspected to have been disposed of along its banks in areas that would include the forested habitat. Based on this information, additional surface soil sampling in these two terrestrial

habitats may be required to define the nature and extent of ecological risk to this endpoint.

Assessment Endpoint No. 5: The maintenance of viable terrestrial carnivore communities in the region based on bio-transfer of arsenic, cadmium, mercury, lead, pesticides, PCBs, dioxins and furans in surface soils.

Hazard quotients for these contaminants of concern were not calculated since USEPA Region 4 does not require dose-exposure modeling in the first two steps of the ecological risk assessment process; however, these bioaccumulative contaminants were detected above ecological screening values.

There are some key areas of uncertainty that can be considered when developing workplans to further investigate ecological risks to this endpoint:

- Historical file information has indicated that the some areas of surface soils containing high contaminant levels have been excavated and removed since the ESI sampling was completed in 1997. These contaminated materials were removed from the site and disposed of as hazardous waste. The excavated areas have been backfilled with topsoil and trees were planted. As a result, data collected during the ESI to characterize surface soils in this area may not be representative of current conditions. This may require the acquisition of additional surface soil samples in this area to determine if a potential risk still exists.

- The lead detected in soil samples from the open field and forested habitats was reported with "JN" qualifiers in the data package. The "JN" qualifier for lead indicates that the laboratory reported an estimated concentration based on presumptive evidence that this inorganic compound was present in the sample. This type of qualifier is very unusual for inorganic compounds and may suggest a problem in the laboratory analysis. The "JN"-qualified data for lead was an order of magnitude higher than the maximum unqualified data point; however, both values were above the ecological screening criteria.

- The SERA considered the maximum detected concentrations of each contaminant in each of the evaluated media. The dose and exposure calculations required to evaluate this assessment endpoint should be based on a representative exposure point concentration. The exposure point concentration should consider the life histories of the respective receptor organisms and may require the use of a site-wide average, a habitat-biased average, the 95 percent upper confidence limit, or other methods of establishing realistic exposure point concentrations.

- The ability to accurately estimate realistic exposure point concentrations is adversely effected by the small data set available for the two of the terrestrial habitats. Only one surface soil sample was collected in the open field area (SS-15) and three soil samples were collected in the same general area within the forested area (SS-11, SS-12, and SS-13). Historical file information indicates that ash was disposed of throughout areas that include the two terrestrial habitats.

In addition, dredged material from Moncrief Creek is suspected to have been disposed of along its banks in areas that would include the forested habitat. Based on this information, additional surface soil sampling in these two terrestrial habitats may be required to define the nature and extent of ecological risk to this endpoint.

Assessment Endpoint No. 6: The maintenance of aquatic insectivore communities in the region based on bio-transfer of mercury, lead, and pesticides in sediments and surface water.

Hazard quotients for these contaminants of concern were not calculated since USEPA Region 4 does not require dose-exposure modeling in the first two steps of the ecological risk assessment process; however, these bioaccumulative contaminants were detected above ecological screening values.

There are some key areas of uncertainty that can be considered when developing workplans to further investigate ecological risks to this endpoint:

- Historical file information has indicated that the sediments in Moncrief Creek were periodically dredged as recently as December 1999. Data collected during the ESI to characterize sediments may not be representative of current conditions since dredging has been known to occur between the ESI in 1997 and December 1999. This may require the acquisition of additional sediment samples to determine if a potential risk still exists.

- The conclusion that there are potential risks to this endpoint are based on contamination observed in two widely spaced sediment samples. There is some evidence that sediment samples collected from Moncrief Creek were not located in depositional areas. As a result, the sediment samples may not be biased toward those areas that could contain the highest contaminant concentrations. In addition, the habitat types in the sediment sample locations were not recorded; therefore, optimal benthic habitats may not be represented. Based on the potential risks and this uncertainty, additional sediment sampling may be required in depositional areas.

- The conclusion that there are potential risks to this endpoint are based on contamination observed in three widely spaced surface water samples (only one of which is downgradient of known areas of waste disposal). These samples may not represent worst case conditions (in groundwater recharge areas) or may not have been collected in areas where fine-grained sediments have been deposited (where contaminant concentrations would be highest). Based on the potential risks and this uncertainty, additional surface water sampling may be required in areas where groundwater concentrations were high and in depositional areas.

- Dieldrin in SD-01 was reported with "JN" qualifiers in the data package indicating that the estimated concentration reported was based on presumptive evidence of the contaminant. The "JN"-qualified data for dieldrin was collected in a sample

collected upgradient of known areas of ash disposal. The estimated concentration of this contaminant was below both the maximum unqualified data point and the ecological screening value; however, the true magnitude of the "JN" qualified data is unknown. This uncertainty does not affect the conclusions of the SERA.

- The SERA considered the maximum detected concentrations of each contaminant in each of the evaluated media. The dose and exposure calculations required to evaluate this assessment endpoint should be based on a representative exposure point concentration. The exposure point concentration should consider the life histories of the respective receptor organisms and may require the use of a site-wide average, a habitat-biased average, the 95 percent upper confidence limit, or other methods of establishing realistic exposure point concentrations. Thorough assessment of this endpoint may also require additional data to measure or estimate concentrations of contaminants in common food items such as benthic invertebrates.

- The ability to accurately estimate realistic exposure point concentrations is adversely effected by the small data set available for aquatic habitat. Only two sediment samples (SD-03 and SD-04) were collected in areas of known ash contamination. Based on this information, additional sediment sampling may be required to define the nature and extent of ecological risk to this endpoint.

Assessment Endpoint No. 7: The maintenance of piscivore communities in the region based on bio-transfer of mercury, lead, and pesticides in sediments and surface water.

Hazard quotients for these contaminants of concern were not calculated since USEPA Region 4 does not require dose-exposure modeling in the first two steps of the ecological risk assessment process; however, these bioaccumulative contaminants were detected above ecological screening values.

There are some key areas of uncertainty that can be considered when developing workplans to further investigate ecological risks to this endpoint:

- Historical file information has indicated that the sediments in Moncrief Creek were periodically dredged as recently as December 1999. Data collected during the ESI to characterize sediments may not be representative of current conditions since dredging has been known to occur between the ESI in 1997 and December 1999. This may require the acquisition of additional sediment samples to determine if a potential risk still exists.

- The conclusion that there are potential risks to this endpoint are based on contamination observed in two widely spaced samples. There is some evidence that sediment samples collected from Moncrief Creek were not located in depositional areas. As a result, the sediment samples may not be biased toward those areas that could contain the highest contaminant concentrations. In addition, the habitat types in the sediment sample locations were not recorded;

therefore, optimal benthic habitats may not be represented. Based on the potential risks and this uncertainty, additional sediment sampling may be required in depositional areas.

- The conclusion that there are potential risks to this endpoint are based on contamination observed in three widely spaced surface water samples (only one of which is downgradient of known areas of waste disposal). These samples may not represent worst case conditions (in groundwater recharge areas) or may not have been collected in areas where fine-grained sediments have been deposited (where contaminant concentrations would be highest). Based on the potential risks and this uncertainty, additional surface water sampling may be required in areas where groundwater concentrations were high and in depositional areas.

- Dieldrin in SD-01 was reported with "JN" qualifiers in the data package indicating that the estimated concentration reported was based on presumptive evidence of the contaminant. The estimated concentration of this contaminant was below both the maximum unqualified data point and the ecological screening value; however, the true magnitude of the concentration of the "JN" qualified data is unknown. This uncertainty does not affect the conclusions of the SERA.

- The SERA considered the maximum detected concentrations of each contaminant in each of the evaluated media. The dose and exposure calculations required to evaluate this assessment endpoint should be based on a representative exposure point concentration. The exposure point concentration should consider the life histories of the respective receptor organisms and may require the use of a site-wide average, a habitat-biased average, the 95 percent upper confidence limit, or other methods of establishing realistic exposure point concentrations. Thorough assessment of this endpoint may also require additional data to measure or estimate concentrations of contaminants in common food items such as fish.

- The ability to accurately estimate realistic exposure point concentrations is adversely effected by the small data set available for aquatic habitat. Only two sediment samples (SD-03 and SD-04) were collected in areas of known ash contamination. Based on this information, additional sediment sampling may be required to define the nature and extent of ecological risk to this endpoint.

3.6.3 Other Sources of Uncertainty

There are other factors in the ecological risk assessment process that may add uncertainty to the conclusions and should be considered when developing ecological workplans. This section will summarize those uncertainties.

- Site Characterization and Habitat - The ecological setting of the site was developed primarily through a one-day site visit and review of supporting information by previous investigators. The result was a cursory review of the habitat and communities likely to be supported by the various habitats on the

site. Observations of wildlife or their sign (or the lack of) are limited due to seasonal fluctuations, daily fluctuations, life histories, and significant human activity in these areas.

- Bioavailability - The presence of a contaminant in environmental media at significant levels does not always indicate that a toxicological effect is inevitable. Other factors may impact a contaminant's bioavailability, that is, its ability to impact a receptor. These factors include the affinity for the contaminant to the media to which it is absorbed, its ability to be absorbed across the gastrointestinal tract, its metabolism once absorbed into the body, its dermal absorption characteristics, and its ability to be absorbed and translocated in plants. For the purposes of the SERA, it was assumed that all of the contaminants in each contaminated media were 100 percent bioavailable. As a result, the actual risks are probably over-represented.

- Tentatively Identified Compounds (TICs) - The presumptive evidence of several extractable organic compounds was noted in the analytical data package. The actual presence and reported concentrations of these contaminants is suspect due to the "JN" qualifier attributed to them. Theses contaminants are not included as part of the target compound list and lack ecological screening values. These contaminants, if present, may add additional uncertainty to the SERA as a whole that should be considered prior to the development of work plans for further activities. In soils, these TICs included alkanes, anthracenedione, cyclopentaphenantherone, benzanthrecenone, benzanaphthothiophene, benzopyrene (not A), and methylenebis(chiloro)benzenamine. In sediments, these TICs included methylanthracene (2 isomers), dimethylphenanthrene, and benzopyrene (not A).

3.7 Scientific/Management Decision Point

Based on the information presented in of Steps 1, 2, and 3 of the ERA process, there are potential ecological risks at the site and the risk assessment should proceed with Steps 4 through 8. Further evaluations conducted at the site to address ecological risks should include an assessment of the risks presented by each contaminant of potential concern (COPC) as indicated in Table 3-2. This list of COPCs is based on the screening and refinement conducted in Steps 1, 2, and 3 of the ERA process. Based on the conclusions of Steps 1, 2, and 3 of the ERA process, several recommendations can be made:

1. Conservative dose-exposure modeling of bio-accumulative contaminants in surface soil and sediment may be helpful. This modeling may rule out the need to evaluate one or more of the food-chain exposure assessment endpoints and eliminate tissue collection and sampling as discussed in several recommendations below.

2. Collection of additional surface water samples in areas where groundwater concentrations were high and in areas of optimal aquatic habitat. This sampling could also include samples collected far enough upstream to represent

background conditions and care should be taken to ensure that data quality objectives will be maintained for site-related contaminants.

3. Collection of additional sediment samples in areas of optimal benthic habitat. Samples could also be obtained in depositional areas such as pools and sandbars. Analysis of the sediment samples could also include a determination of the physical characteristics of the sample for metrics such as total organic carbon (TOC) and grain size.

4. Collection of additional surface soil samples in the open field and forested habitats to allow the calculation of a statistically valid exposure point concentration and determine the nature and extent of site-related contamination in these areas. The excavated and backfilled area could also re-sampled to verify that all surficial contamination was removed by the excavation. Care should be taken to ensure that data quality objectives will be maintained for site-related contaminants.

3.8 Summary

Based on the development of the Problem Formulation and the SMDP presented above, it can be concluded that there is a potential for ecological risks at the site based on the information presently available. Further investigations, as described previously, should be conducted to determine the extent of contamination and risks at the site.

Table 3-2
List of Final Contaminants of Potential Concern for Further Evaluation
Brown's Dump Site

Analyte	Surface Soil COPC?	Sediment COPC?	Surface Water COPC?	Groundwater COPC
Inorganics				
Aluminum	Yes	Yes	No	Yes
Antimony	Yes	No	No	No
Arsenic	Yes	No	No	No
Barium	Yes	Yes	Yes	Yes
Cadmium	Yes	Yes	No	Yes
Chromium	Yes	No	No	No
Cobalt	No	Yes	No	Yes
Copper	Yes	Yes	No	Yes
Cyanide	Yes	Yes	No	No
Iron	Yes	Yes	No	Yes
Lead	Yes	Yes	Yes	Yes
Manganese	Yes	Yes	Yes	Yes
Mercury (Total)	Yes	Yes	No	No
Nickel	Yes	Yes	No	No
Silver	Yes	No	No	No
Vanadium	Yes	Yes	No	Yes
Zinc	Yes	Yes	Yes	Yes
Semi-Volatiles/Extractables				
Carbazole	Yes	Yes	No	No
Fluorene	Yes	No	No	No
Phenanthrene	Yes	Yes	No	No
Anthracene	Yes	No	No	No
Fluoranthene	Yes	Yes	No	No
Pyrene	Yes	No	No	No
Benzo(a)anthracene	Yes	Yes	No	No
Chrysene	Yes	Yes	No	No
Bis(2-ethylhexyl)pthalate	Yes	No	No	No
Benzo(b/k)fluoranthene	Yes	Yes	No	No
Benzo(a)pyrene	Yes	Yes	No	No
Indeno(1,2,3-cd)pyrene	Yes	Yes	No	No
Dibenzo(a,h)anthracene	Yes	No	No	No
Benzo(g,h,i)perylene	Yes	Yes	No	No
Naphthalene	Yes	No	No	No
Dibenzofuran	Yes	No	No	No
Acenapthylene	Yes	No	No	No
Pesticides/PCBs				
4,4-DDE	Yes	No	No	No
4,4-DDD	Yes	Yes	No	No
4,4-DDT	Yes	No	No	No
Gamma-BHC	No	Yes	No	No
Dieldrin	Yes	Yes	No	No
Endrin	Yes	Yes	No	No
Heptaclor	No	Yes	No	No
PCB 1254	Yes	No	No	No
PCB 1260	Yes	No	No	No
Dioxin/Furan				
Tetrachlorodibenzodioxin (total)	Yes	No	No	No
Pentachlorodibenzodioxin (total)	Yes	No	No	No
Hexachlorodibenzodioxin (total)	Yes	No	No	No
Heptachlorodibenzodioxin (total)	Yes	No	No	No
Octachlorodibenzodioxin	Yes	No	No	No
Tetrachlorodibenzofuran (total)	Yes	No	No	No
Pentachlorodibenzofuran (total)	Yes	No	No	No
Hexachlorodibenzofuran (total)	Yes	No	No	No
Heptachlorodibenzofuran (total)	Yes	No	No	No
Octachlorodibenzofuran	Yes	No	No	No

4. REFERENCES

ATSDR (Agency for Toxic Substances and Disease Control). 1992-1999. Various toxicological profiles available from the U.S. Department of Health and Human Services, Atlanta, Georgia.

Efroymson, R.A., M.E, Suter, G.W., and Wooten A.C. 1997a. Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Terrestrial Plants: 1997 Revision. Prepared by Lockheed Martin Energy Systems Inc.

Efroymson, R.A., Will, M.E, and Suter, G.W. 1997b. Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Soil and Litter Invertebrates and Heterotrophic Process: 1997 Revision. Prepared by Lockheed Martin Energy Systems Inc.

Sample et al. 1996. B.E. Sample, D. M. Opresko, and G.W. Suter, *Toxicological Benchmarks for Wildlife*, Lockheed Martin Energy Systems, Inc. prepared for U.S. Department of Energy, ES/ER/TM-86/R3, 1996.

USEPA 1995. Supplemental Guidance to RAGS: Region 4 Bulletins. Ecological Screening Values - Ecological Risk Assessment, Bulletin No. 2, December 1998.

USEPA 1997. U.S. Environmental Protection Agency Environmental Response Team, Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments - Interim Final. EPA 540-R-97-006. June 5, 1997.

USEPA 1999. U.S. Environmental Protection Agency Region 4 Ecological Risk Assessment Bulletins – Supplemental to RAGS – Draft. August 11, 1999.